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1,001 USES FOR CESPG OUTPUT: HOW TO TURN DATA INTO INFORMATION

Engineer
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13. ABSTRACT *(Maximum 200 words)*

This study was sponsored by the Joint Chiefs of Staff, J4 Civil Engineer Branch. The purpose of the report is to impart methods and data analysis techniques developed by the Engineer Studies Center to civil engineer planners that rely on the Civil Engineer Support Plan Generator (CESPG) model. The CESPG is used as the basis for developing the Civil Engineer Support Plan that is included as an appendix to the Logistics Annex in all theater, service, and major command (MACOM) level operations plans (OPLAN). Unfortunately the CESPG is one of the most complicated, misunderstood, and frustating models to work with. This handbook provides planners and users with an overview of the model: how the files interact and why you should care (the phrase "garbage-in, garbage-out" comes to mind); detailed discussions on each of the input files: what they represent and what to look for; "tips and tricks" regarding manipulation of the input; and finally presentation methods of the output data to support decision-making in the areas of time-phased force deployment list (TPFDL) restructuring, OPLAN supportability, and host nation support requirements.

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Prepared By
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The Civil Engineer Support Plan Generator (CESPG) is not an easy animal to understand. It has taken me years to figure out the basics of the system. I find with each application, that there is some other quirk that emerges that I never knew existed. Since no one individual can claim the right to "knowing all there is to know" about the CESPG, I would like to thank the following individuals, who over the years have helped to increase my knowledge base with their patience, understanding, and willingness to share information:

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I. INTRODUCTION

1. **PURPOSE.** This user's guide provides civil engineer planners with methods that use computer generated data to support deliberate planning. Over the last five years I have had the privilege, or many of you would say the misfortune, to use the Civil Engineer Support Plan Generator (CESPG) as the basis to generate engineer requirements for several Army and Joint engineer assessments conducted by the Engineer Studies Center (ESC). The problems one faces when using the CESPG often seem insurmountable, but I have found that given a little stamina and fortitude you ***really can*** get useful data from the model.

2. **SCOPE.** The handbook includes:

- A brief background on the CESPG model, its intended uses, traditional complaints, and problems.
- An overview of the model, its structure and output.
- Presentation of methods ESC has developed for use in various engineer assessments to support theater level planning.

3. **BACKGROUND.**

a. This handbook is not the typical CESPG "user's guide" written in "computerese" that only confuses and confounds you. The main purpose is to provide you with insights and methods for using that two-foot high printout of CESPG results. Equations and detailed mathematical explanations will not be found, rather I'll show samples of how we've arrayed the data. Also, I'll show you some of the graphics displays we've used to help the decision-maker interpret the impact of the results. I hope you, in your role of CESPG action officer, find this report makes the best use of your limited time. So lets start at the beginning...

b. The CESPG model was developed in the 1970's. Its purpose is to provide theater-level planners from all services a unified, consistent, and comparable method of determining engineer requirements at echelons above corps and assess the ability of the available engineer forces to accomplish those requirements. The model is closely tied to the time-phased force deployment list (TPFDL), and generates engineer support tasks as units arrive in the area of operations (AO).

c. Data generated by the model can support decision-making in four main areas:

(1) ***TPFDL Structuring.*** The requirements generated by the model can assist you in justifying ***how many*** engineers should be placed on the TPFDL deployment schedule, ***when*** they need to arrive, and ***what locations*** need the most engineer support.

(2) ***OPLAN Supportability.*** Data from the CESPG also helps in identifying shortfalls and excesses in engineer support by base complex. This provides a basis for your commander to assess the risks to the success of the operations plan (OPLAN) associated with unaccomplished tasks, and to plan for other means to accomplish those tasks.

(3) ***Class IV Requirements.*** Class IV tonnage requirements generated by the CESPG can be used by logisticians in planning movement of men and materials.

(4) ***Host Nation Support.*** You can also use the model's output to identify possible areas for host nation or contract support agreements based on the type, amount, and timing of the requirements.

d. Because this is a circa-70s program, it is tied to a main-frame computer (Honeywell is the current model) hidden away in an air-conditioned room where access is limited and passwords and permissions are required. Access to the model is through a PC-style terminal attached to the WWMCCS (worldwide military command and control system). This access is limited to changing data in the input files or the parameters the model operates under. All the output is provided through paper copy, fixed format reports.[1] Even error listings, created when data and files are cross-checked, are available through hard-copy printouts only. What this means to you as a user, is that you never know if the changes you made to a file were accepted or if the model ran successfully until the files are run through an update program or you look at the final reports printed at the end of the model run.

e. The structures used to change data in the files are also tied to technology from the 1970s. Many of you may recall when all input to a main-frame computer was accomplished through key-punching information on 80-column cards. The computer advances of the 1980s which allow for on-screen data changes and instantaneous error reports are not readily available with the current model.[2]

f. This all sounds pretty dismal, and you may be wondering "Why is anyone even bothering to write a user's guide?" The answer is simply that the CESPG is the **only** tool available to civil engineer war planners at this time. Instead of wasting time criticizing it, ESC believes if you understand its capabilities and limitations, and the role you play in the process, that it can only improve the level of planning now and in the future.

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[1] The basic file used to generate all these reports, the TABWORK file, can be downloaded from the Honeywell to either magnetic tape or floppy disc. This allows you to load it into a local program such as LOTUS 123, R-Base, or DBase to perform various computations.

[2] On-screen "Forms" have been developed that will allow you to make changes to the data files without running a separate update program. However, they do not pull the data file onto your computer screen and allow you to move to the data field you wish to correct and make the necessary changes. You still must follow the same basic logic described in the CESPG Users Manual. The 416th Engineer Command computer experts have been able to access certain data files and make on-screen changes to them. I suggest you contact them to see if you have the right hardware and software to do the same.

II. CESPG MYTHS AND REALITIES

4. **MYTHS AND REALITIES.** This section touches on some of the complaints I have heard over the last five years and tries to put them to rest. Since the system has been around for over 12 years, many of the initial problems or shortcomings have been corrected, but past users continue to site old problems.

a. **MYTH:** Output from the CESPG reflects temporary construction standards.

REALITY: The Army, Navy, and Air Force have all made concerted efforts over the last several years to change beddown facilities to initial construction standards. What this means is that bladders are being installed for fuel storage rather then steel walled tanks, etc.. However, higher construction standard facility components are still available for the planner's use if you decide that temporary standards are appropriate.

b. **MYTH:** CESPG can be used as a project management tool.

REALITY: The CESPG is a deliberate planning tool. It cannot serve to oversee the execution of projects. Many people believe that since the model generates discrete projects at specific locations over the course of the scenario and that it comes complete with a schedular system, that it is also a project management program.

The model does provide time-phased estimates of facility and man-power requirements that match a given TPFDL flow of forces. However, the key word is "estimate." Remember that the majority of requirements are generated based on universally applied planning factors. The CESPG also "estimates" how many of these requirements can be accomplished by the engineer forces scheduled for the theater according to a strict set of assumptions and priorities. It does not provide the day-by-day planning controls required for real-time execution.

c. **MYTH:** The CESPG **is** the Civil Engineer Support Plan Annex included in the OPLAN.

REALITY: The CESPG simply provides data to the planner. You must take this data, analyze it in light of other information you have available on material availability, unit readiness and support priorities at various locations, etc. to develop the Engineer Annex to the OPLAN. This step has rarely been taken in the past. With the increased use of personal computers most planners can now perform some basic analysis on the data.

d. **MYTH:** The scheduler portion of the CESPG accurately portrays the use of engineers forces in the AO.

REALITY: From my years of experience, I would have to say that no one quite understands how the scheduler uses existing capability against projects that are generated. In theory, engineer capability is placed against the highest priority projects as defined at theater level. In addition, the engineer capability is only applied to projects generated at the base complex that the TPFDL lists as their final destination. In reality, engineer units normally operate on an area support concept. Even though the CESPG adds another million factors to adjust the available capability (such as efficiency phase-in factors, attrition rates, equipment replacement cycles and skill substitution factors), the final result is the same...very few projects are accomplished and the capability is never fully applied.
You would be better served coming up with your own method of comparing capability to requirements. Later in this handbook I'll show you one method that ESC has developed to overcome this problem.

III. MODEL STRUCTURE AND OUTPUT

5. **OVERVIEW.** The CESPG is composed of input files, program run parameters/options (Run Deck cards in the program operators language), input file up-date and creation programs (JCLs or Maintenance Modules to the computer operator), and a series of "programs" referred to by your operations people as "Decks". The programs all do a number of things, from cross-checking the data in input files, to developing a troop file from the TPFDL, to calculating requirements and scheduling engineer capability. The graphic in **Figure 1** shows how the programs work together. A more detailed view of the model and when the various files are used or created is displayed in a series of four graphics found in the *Appendix to Annex A.*

6. **GENERATION OF REQUIREMENTS.** A majority of all requirements are generated by multiplying planning factors by the number of people in a unit or the number of aircraft arriving at a specific location (defined by the final destination geolocation code on the TPFDL). Other planning factors determine facility support needs at the destination (or base location in CESPese) based on its use (air base), or based on its primary occupants (Army, Air Force, Navy, or Marine Corps units). The planning factors are derived from the Joint Chiefs of Staff Memorandum 275-89.[3] The factors are developed to be universal, not theater specific. Each unified commander (CINC) can approve a set of theater specific factors if necessary. The remaining requirements come from either a special projects file (known as the L-cards) or are based on a unit's operational requirements listed in the Master File.

7. **INPUT FILES.** The number of input files each service planner needs to review can be overwhelming even to the most seasoned CESPG user. But, it must be done to ensure the data accurately reflects the assumptions of his OPLAN.

a. In addition to the TPFDL and planning factors, other items to review include: the priority of construction projects; engineer capability; logistics supply base hierarchy (by class of material); construction policies at each base complex for each facility; base complexes and service ownership; facility requirements by unit type code (UTC); available and existing assets; facility requirements not covered by planning factors; war damage; manhours; and material cost and short/measured tons needed to construct standard-sized facilities.

b. Unfortunately, in your role as the CESPG planner, you need to take a look into all these files to ensure the data that resides in them reflects the guidance and policies provided by your CINC and service chief. For example:

(1) ***Planning Factors.*** If you are operating in a desert environment, is 15 gallons of water per man per day adequate? How many days of water storage do you want at each base? Right now, the factor will build only one day's supply. Does the CINC want three days or five days? Be sure you also account for the days of supply stockage objective contained in the OPLAN.

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[3] *"Planning Factors for Military Construction in Contingency Operations"*, Memorandum from the Joint Chiefs of Staff (MJCS-275-89), 13 December 1989.

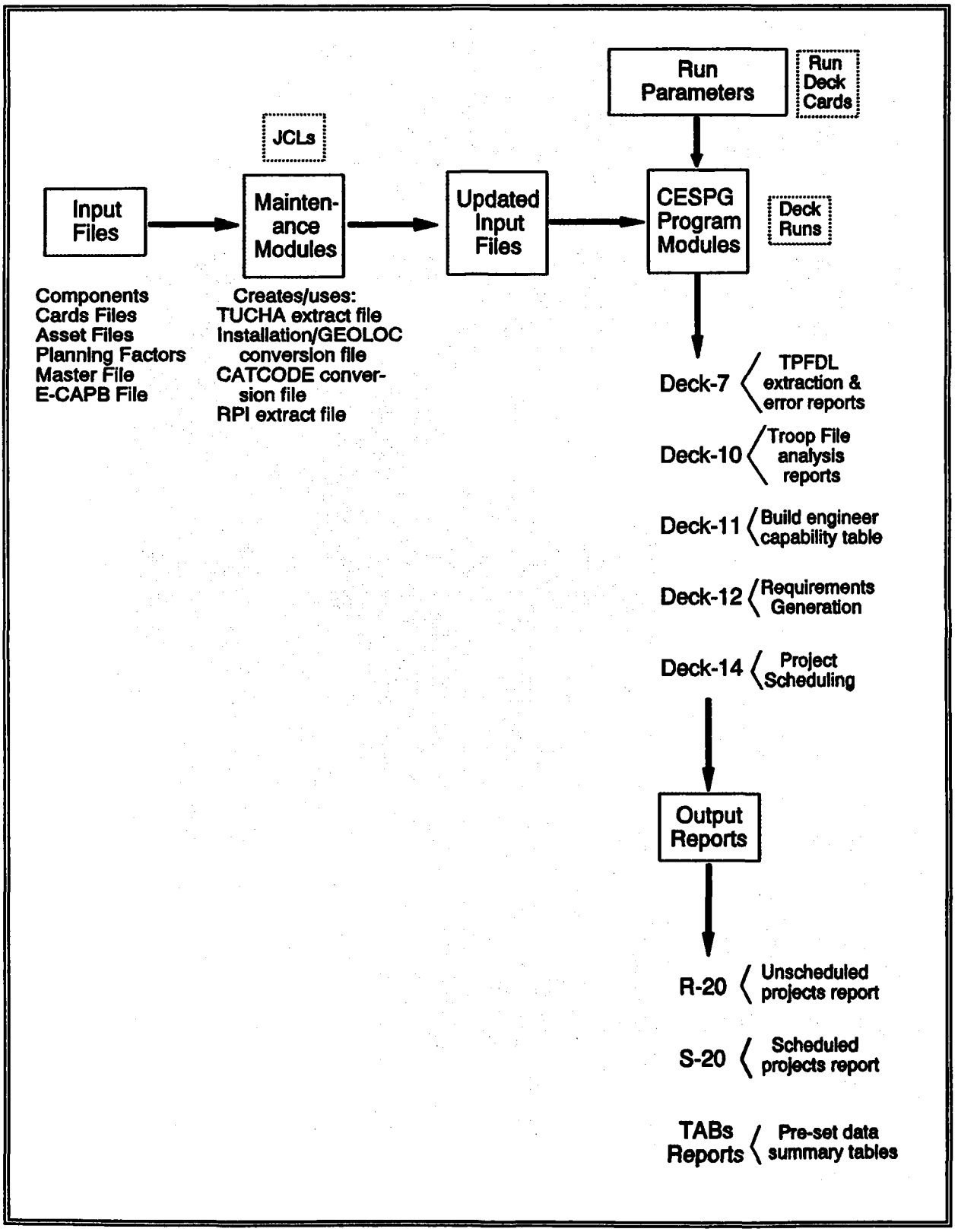

Figure 1. OVERVIEW OF CESPG PROGRAMS

(2) ***Components File.*** What about billeting/berthing of your troops? Are we talking tents or wood frame buildings? The manhours generated are significantly different.

(3) ***Construction Policy (D-cards).*** What about construction of arm/disarm pads at each airbase (currently the model builds this at each airbase)? Are they needed only at air bases that will stage fighters and not refuelers?

c. The old computer adage "garbage in, garbage out" still applies. If you do not take the time to review the input, you can never figure out why you got the output. **Figure 2** provides an overview of each of the input files. A more detailed review of each file is given in *Annex A.*

8. **OUTPUT REPORTS.** The CESPG has three basic classes of reports: error listings, file listings, and data summary reports. Each of these are only available as hard-copy computer printouts.

a. **Error Listings.** The JCLs/maintenance modules and Deck runs both produce hard-copy listings of errors found in the various input files. These errors can range from mistyped entries, to errors found when certain elements are cross-checked with the same element found in another data file. For example, if a GEOLOC is in the TPFDL, but not in the list of Base complexes (A-cards) an error will result.

b. **File Listings.** The JCLs/maintenance modules and Deck runs also produce formatted hardcopy reports of the data contained in the various input files and the files generated by the Deck runs themselves. Examples of the input file listings are given in *Annex A.*

c. **Data Summary Reports.** The Deck-12 and Deck-14 runs produce formatted lists of requirements and scheduled projects by base complex and C-date. Summary reports of this same data sorted in different ways are provided in what are known as the TABs reports. **Figure 3** lists the TABs reports currently available. For a more detailed description of each of the TABs reports see the Joint Operational Planning System (JOPS) User's Manual (pages 2-23 and 2-24, and B-55 through B-98).[4]

[4] *Joint Operation Planning System (JOPS) Civil Engineering Support Plan Generator (CESPG) Users Manual*, Joint Data Systems Support Center, 1 April 1986.

INPUT FILE	DESCRIPTION
ECAPB File--Engineer Capability	Provides daily engineer unit capability in horizontal, vertical, and general manhours.
Component Definition File	Lists for each facility code, the cost, class IV tonnage, daily manhours and number of days to construct.
G-Cards--JCS Category Descriptions and Priorities	Based on the OPLAN, lays out which engineer tasks (by JCS category code) will be included in the model and the priority of those tasks (i.e., which will be done by the limited engineer resources first).
A-Cards--Base Definitions	Groups TPFDL GEOLOCs into areas/bases which reflect the employment concept of engineer assets.
D-Cards--Base Construction Policies	States the policy that will apply to a list of 125 JCS category codes at each base complex (always build, never build, build for non-combat only, or do not build-but inflict war damage).
Asset Files--Host Nation and U.S. Assets	Lists by GEOLOC, base complex, and JCS category code the size of facilities available to offset requirements. Also contains estimates of war damage to existing facilities used to generate engineer repair tasks.
L-Cards--Externally Derived Construction Project Requirements	Allows planners to account for tasks not automatically generated by the model, such as pipelines and MSR maintenance.
Planning Factors	Used to generate engineer support requirements at a base complex based on incoming populations, aircraft, or type of base.
Master File--Unit-Allocated Facilities	Used to generate engineer support requirements by unit or type of equipment.
C-Cards--Base Supply Structure	Specifies logistics resupply structure for each base complex. Generates depot-type storage facilities at selected base complexes.
P-Cards--Host Nation Construction Responsibility	Specifies manhours of host nation labor available at given base complexes to perform certain tasks.

Figure 2. CESPG DATA FILES

REPORT NAME	SECTION NUMBER	REPORT TITLE
TAB A	A-I	Summary of Facility Deficiencies by Service
	A-II	Base Deficiencies
	A-III	Facility Requirements, Assets, and Deficiencies by Base
	A-IV	Civil Engineering Facility Projects Time-phased by Base
TAB B	B-I	Consolidated Material Requirements by Time Period, by Service
	B-II	Time-phased Material Requirements by Base
	B-III	Material Requirements Time-phased by Service, by Base
	B-IV	Consolidated Material Requirements Time-phased by Service
TAB C	C-I	Time-phased Civil Engineering Force Requirements (Area Wide)
	C-II	Time-phased Civil Engineering Force Requirements (Planning Area Totals by Project Class)
	C-III	Time-phased Civil Engineering Force Requirements by Base
	C-IV	Time-phased Civil Engineering Force Requirements by Project Class by Base
TAB D	D-I	Percentage of High 30-Day Average by Category Code
	D-II	Percent of 30-Day Averages by Category Code
	D-III	Time-phased Manpower Requirements by Project Class
	D-IV	Time-phased Manpower Requirements by Time Period
TAB E	E-III	Facility Projects Identified for Host Nation Accomplishment
TAB F	F-I	Facility Requirements, Assets, and Deficiencies
	F-II	Time-phased Material Requirements by Base and Material Requirements Time-phased by Service, by Base
	F-III	Time-phased Civil Engineering Force Requirements by Base and Time-phased Civil Engineering Force Requirements by Project Class by Base
	F-IV	Percentage of High 30-day Average by Category Code and Percent of 30-day Averages by Category Code
	F-V	U.S. Provided and Host Nation Provided Assets

Figure 3. TABS DATA SUMMARY REPORTS

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IV. METHODS TO TURN DATA INTO INFORMATION

9. **OVERVIEW.** Now that you have an idea of how the CESPG operates and what it can be used for, I'd like to go into some ways ESC has developed to look at the data produced by the model to support those uses. We've used the CESPG to assess echelons above corps (EAC) engineer support in Korea, Southwest Asia, Europe, and the Mediterranean. By taking the basic requirements information we have been able to recommend changes to existing TPFDLs, evaluate OPLAN supportability, and identify areas for host nation support. So how did we do this?

a. First, we review the existing input files and update them to reflect construction standards and policies for the OPLAN. We meet with users of engineer support to determine any unique requirements they may have. For the Army this includes the transporters, military police (MP), medical, etc.. The transportation units are able to identify trailer transfer points, marshalling yards, logistics-over-the-shore operations, and main supply routes (MSR) needing maintenance. The MP units describe enemy prisoner of war (EPW) camp sizes, locations, and requirements. We examine existing planning documents, doctrinal manuals, study reports, recent exercise results, and intelligence data in an effort to identify other engineer support requirements. All this information is used to adjust the input.

b. Once the information is entered into the CESPG, and the model run, the data that results is downloaded onto magnetic tape or floppy disc. The file we use is known as the TABWORK file. This file contains all the data produced by the model for each project and is the file used to produce the data summary reports. ESC developed a PC DBase IV program that takes the data contained in the TABWORK file and formats it to allow us to produce our own TAB-like reports and perform our analyses. Both the 412th and 416th Engineer Commands (ENCOMs) have developed individual data-base management programs. The 412th ENCOM program, called CONSTRUC, uses DBase III or IV to rapidly analyze data. The 416th ENCOM uses R-Base to sort data and produce reports. Naval Facilities Engineering Command (NAVFAC) has also developed programs to present the data to support their needs.

c. ESC uses this summarized data in LOTUS 123 spreadsheets to look at the data in various ways. We are primarily interested in the number of manhours required to perform the engineer tasks over time. Instead of looking at individual tasks, our analysis concentrates on groups of tasks that have similar priorities. We also look at these tasks more on a regional basis then on a base-by-base case. This gets the analysis away from the idea that the CESPG results represent "real-time" projects (remember that this is only a planning tool, not an execution tool). Instead ESC looks at the results of the model as reflecting "amounts" of engineer support. Whether or not a given project is needed at a specific day will depend on many different factors in the field. However, you can assume that over a period of time engineers would be required to perform so many manhours of effort related to similar projects at a base or within an area containing several bases.

10. **REFORMATTING DATA FROM THE TABWORK FILE.** All the data produced by the CESPG model is located in the TABWORK file. A sample of the structure of this file is given in **Figure 4.** One record, containing all these fields, exists for each project generated by the CESPG.

DATA FIELD	COMMENTS
Project Number	Sequential number assigned by the CESPG as the requirement is generated (must divide by 100 to get the actual project number)
Base Complex Number	Defined in the A-cards
Priority of Project	Defined in the G-cards for the JCS CATCODE field
Required Completion Date	Date the facility is needed (must subtract 100 from the value given in the file)
JCS CATCODE	
Facility Quantity Required	Must divide this value by 10 to get actual requirement
Component Code	Selected from the Components File
Component Amount	The number of components needed to meet the "Facility Quantity Required" field (must divide by 100 to get actual requirement)
Scheduled Completion Date	Date project would be completed given available capability
Scheduled Start Date	Date project would begin given available capability
Constructing Agency	Army, Navy, Air Force, Marines, Host Nation (P-cards), or Existing Assets (U.S. or host nation)
Project Type Code	Identifies how project was generated, e.g., by planning factors, special project L-cards, Master File unit allocated, or war damage
Using Service	Service the work is being done for (same listing as for constructing service)
Component Size	The value listed for a single component in the Components File
Unit of Measure	
Component Cost	Extracted from the components file (multiply by the Component Amount field to calculate total project cost)
Short Tons	Same as above
Measurement Tons	Same as above
Horizontal Manhours	Total manhours for one component (multiply by the Component Amount field to calculate total manhours for the project)
Vertical Manhours	Same as above
Other Manhours	Same as above
Days to Build	Extracted from components file
Component Description	
Base Name	
JCS CATCODE Description	
Day Number	In C-days from start of scenario
Total Project Manhours	Sum of all skill category fields multiplied by the Component Amount field

Figure 4. DATA ELEMENTS CONTAINED IN THE TABWORK FILE

a. To perform our analyses we extract portions of each TABWORK record, and do some preliminary calculations on the man-hour totals. As shown in Figure 4, the TABWORK file only lists manhours as a total of each construction skill type needed to construct one facility component or a total of all skill types for the entire project. We have found it most helpful in our efforts to set up a data base that takes the construction skill manhours multiplied by the number of components required, to reach a separate project total for each skill. Those totals are then divided between scenario-based time periods according to the date required and the number of days needed to construct the facility.

b. The graphic in **Figure 5** helps to illustrate this process. If it takes five days and a total of 1,000 manhours to construct a facility, on the average it would require 200 manhours each of the five days. If the time periods for our scenario are broken into 10 day time periods (beginning at C+0), and the requirement date for the facility to be completed is C+12, then on days C+8 and C+9 (in period 1 = C+0 - C+9) we would have 200 hours of effort each day for a total of 400 manhours. The remaining three days and 600 manhours of construction fall in time period 2 (C+10 - C+19).

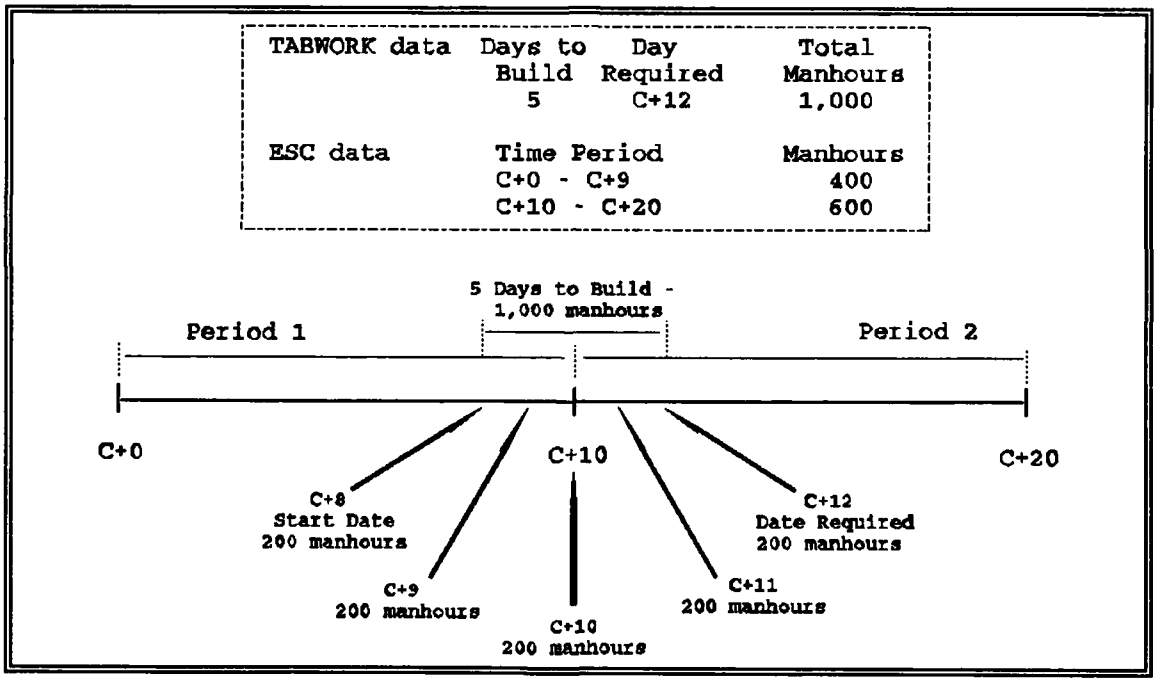


Figure 5. DIFFERENCES BETWEEN TABWORK AND ESC DATA BASES

c. Since we concentrate on the manhours of effort generated by the model, this method is applied to each project listed in the TABWORK file and the manhours given for each of the three construction skill types (horizontal, vertical, and other). From this we can organize and combine the data in any fashion needed. All the tables and graphics given as examples in this handbook are derived from this "revision" of the TABWORK data file.

11. **DATA ORGANIZATION.** There are several ways to combine the data provided by the TABWORK file. The different levels we use include grouping data by priority, dividing the manhours into time periods, looking at the requirements within geographic regions, or splitting the data along service lines.

a. **Prioritizing Requirements.** As mentioned previously, we look at the requirements as a representation or estimate of the amount and type of support engineers can expect to provide within a given span of time. To ensure that the capability is used against the most important requirements first, we prioritize the tasks.

(1) To get away from the idea of discrete projects, we ask service representatives to review a list of likely engineer tasks we identify through our discussions and research, and place them into groups they see as having similar importance.

(2) They are then asked to identify whether these groups are considered Priority 1, 2, or 3 (or Vital, Critical, Essential, or however their ranking system is structured). Once the groups are labeled, they are then asked to rank order the groups within the priority.

(3) In the final step, the JCS CATCODEs used in the CESPG are associated with the tasks and we group the output data accordingly. An example is shown in **Figure 6.**

PRIORITY	INCREMENT NUMBER	INDIVIDUAL TASKS BY CATCODE
1	1 - Repair of critical airfield facilities	111RW - Emergency repair of runways 112RW - Emergency repair of taxiways 113RW - Emergency repair of aprons 149BW - Emergency repair of arresting barriers
	2 - Construction of critical facilities	111AB - Runways 112AB - Taxiways 149AB - Aircraft revetments (initial standards)
2	3 - Emergency troop billeting	725AB - Troop housing 725BB - Troop messing
	4 - Repair of operational facilities	133AW - Control tower 116AW - Aircraft wash rack 141DW - Hardened aircraft shelters

Figure 6. SAMPLE APPROACH TO DEVELOPING ENGINEER TASK PRIORITIES

b. **Time Periods.** The data is also organized into time periods to associate the generation of requirements with the timing of scenario events and the arrival of engineer units.

c. **Geographic Region.** Grouping data by geographic areas helps us look at the requirements that would be faced by engineers operating in an area support role. In the case of a Central Europe study, we grouped the data to represent requirements within Area Support Group (ASG) regions. In the Mediterranean study we grouped data by Area Wartime Construction

Management (AWCM) Regions. The table in **Figure 7** shows a sample of how our data base looks after it's been grouped by priority, time period, and geographic region.

REGION 1 (Bases 1, 10, 12, & 15)		MANHOURS OF EFFORT (Total per Time Period)			
Priority 1	**Time Periods**	**Horizontal**	**Vertical**	**General**	**Total**
	C+0 - C+10	11,058	32,309	8,921	52,288
	C+11 - C+25	16,945	19,289	17,936	54,170
	C+26 - C+40	15,206	1,877	11,960	29,043
	C+41 - C+60	14,535	1,289	10,365	26,189
	C+61 - C+80	5,922	25	7,191	13,138
	C+81 - C+100	5,912	0	7,181	13,093
	C+101 - C+130	5,912	0	7,181	13,093
	TOTAL	**75,490**	**54,789**	**70,735**	**201,014**

Figure 7. SAMPLE ARRAY OF DATA SORTED BY GEOGRAPHIC REGION AND PRIORITY

d. **Service Lines.** We also need to take the data given in Figure 7 and look at how much of it is generated to support one service versus another in a region. In that case two sets of tables are generated, one for each service (**Figure 8**).

REGION 1 (Bases 1,10,12,& 15)		MANHOURS OF EFFORT (Total per Time Period)								
Prty 1	Time Periods	ARMY REQUIREMENTS				AIR FORCE REQUIREMENTS				Total from Fig 7
		Horz	Vert	Gen	Total	Horz	Vert	Gen	Total	
	C+0 - C+10	6,320	20,735	5,168	32,223	4,738	11,574	3,753	20,065	52,288
	C+11 - C+25	10,615	9,520	10,134	30,269	6,330	9,769	7,802	23,901	54,170
	C+26 - C+40	11,350	500	6,489	18,339	3,856	1,377	5,471	10,704	29,043
	C+41 - C+60	9,117	476	6,168	15,761	5,418	813	4,197	10,428	26,189
	C+61 - C+80	4,010	25	4,501	8,536	1,912	0	2,690	4,602	13,138
	C+81 - C+100	3,990	0	3,866	7,856	1,922	0	3,315	5,237	13,093
	C+101 - C+130	3,800	0	3,722	7,522	2,112	0	3,459	5,571	13,093
	TOTAL	**49,202**	**31,256**	**40,048**	**120,506**	**26,288**	**23,533**	**30,687**	**80,508**	**201,014**

Figure 8. SAMPLE ARRAY OF DATA SPLIT OUT BY SERVICE

12. **PRESENTATION OF CESPG RESULTS.** Now that we have the data assembled to do our analyses, let's take a look at some of the methods. The first thing we try to do is get a feel for the requirements. The presentation of data in the tables shown in Figures 7 and 8 give you the numbers, but not a good visualization of what's going on. I've found it helpful to look at the data both as "totals" of groups and also "time-phased". To illustrate this, I've gathered together a series of graphics and tables to show you several different ways to help you get a "feel" for your results.

a. **Scenario and Data.** I've developed a basic example that has two services represented, three priority groups, two regions and four time periods. The table below (**Figure 9**) displays the parameters of the sample scenario. Our CESPG example has a total of seven bases. Four of the bases are grouped into Region 1, while the remaining three comprise Region 2. The time periods are broken into 10-day increments, starting at C+0. The three priority categories are broken into task increment groups. The CATCODEs that make up each increment group are also listed. The data tables on which all the remaining graphics and charts are developed are provided in *Annex B.*

b. **Requirements Analysis.** There are numerous ways to display the sample scenario data. The method you select will depend upon your final objectives. Are you most interested in total

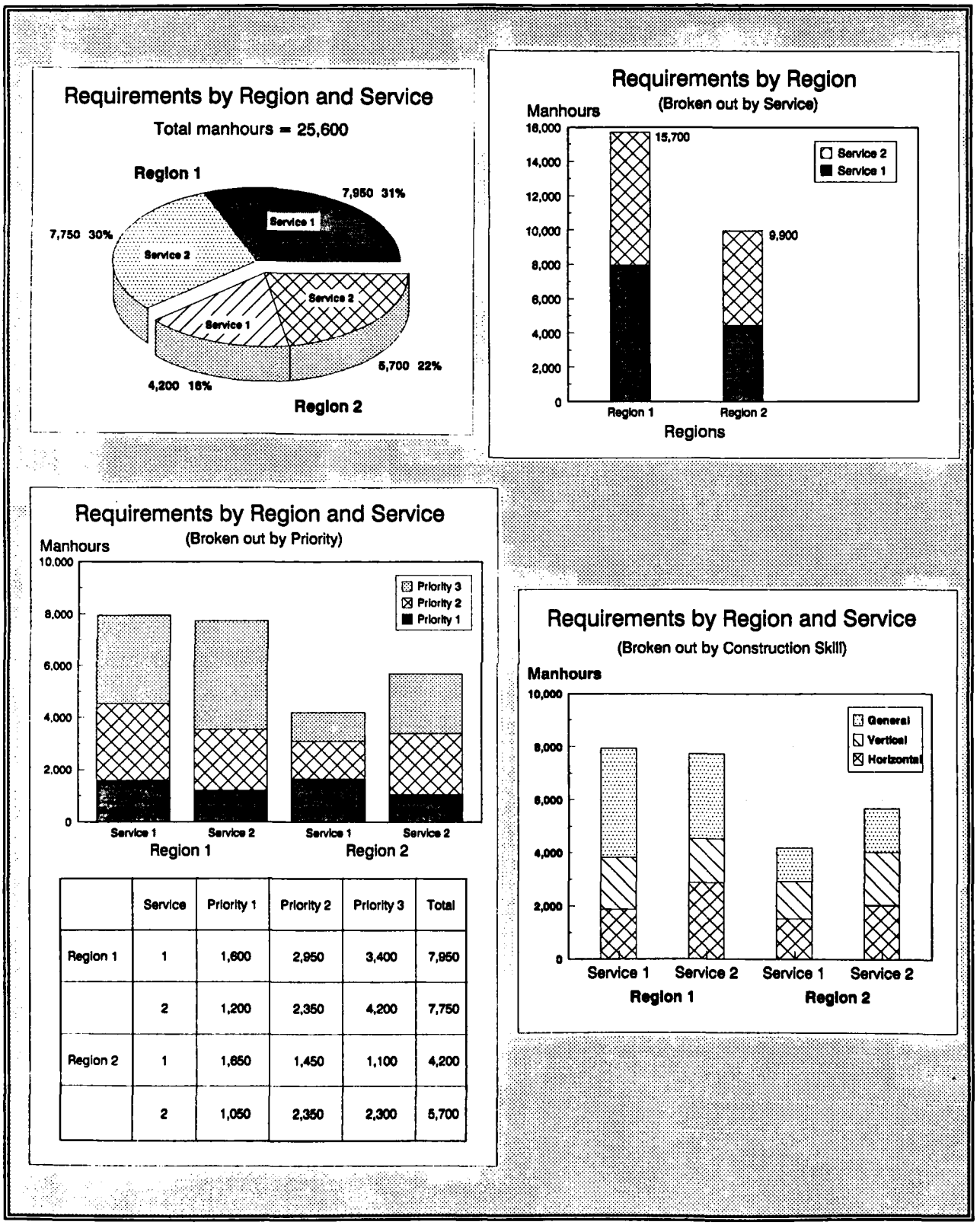
REG.	BASES	TIME PERIOD	PRTY	INCREMENT	CATCODES
1	1, 10, 12 & 15	C+0 - C+9	1	1 - Airfield damage repair	111RW, 112RW, 113AW
2	30, 35 & 42	C+10 - C+19		2 - Repair of fuel storage and main supply routes	411CW, 411DW, 411EW, 851AW, 851BW
		C+20 - C+29	2	3 - Hospital beddown and base camp development	510AB, 550BB, 725AB, 725BB
		C+30 - C+39		4 - Revetments for aircraft	149AB, 149AW
			3	5 - Storage and critical maintenance facilities	441AB, 442AB, 214AB, 211AB, 217AB

Figure 9. SAMPLE SCENARIO PARAMETERS

requirements for a theater, requirements by service, by construction skill, or would you like to see how the requirements are generated over time? Do you want to look at manhours or facility quantities? What about certain classes of facilities? Are you looking at TPFDL deployments or justification for numbers and types of units? Or are you trying to determine types and amounts of host nation support required?

(1) ***Group Totals***. The graphics in **Figure 10** show some of the many approaches available, remember that these types of displays can be used for whatever combination of factors you are looking at. Displaying information this way shows that Region 1 generates more engineer requirements than Region 2. Where do you currently have the most engineers? It also appears that Service 2 needs more engineer support than Service 1, and has more requirements for horizontal construction skills. Does Service 2 have enough capability to handle this, and does it have the right mix of construction skills and equipment? Service 1 generates more Priority 1 and 2 requirements then Service 2. If you define Priority 1 requirements as war-stoppers, then perhaps more engineer support is needed for Service 1, even though Service 2 generates more overall requirements. Priority 3 requirements in Region 1 are almost as great as the Priority 1 and 2 requirements combined. Perhaps host nation support is needed to accomplish these tasks. Whether that support is in the form of facilities or labor could be determined by looking at the data in more detail.

(2) ***Time-Phased Totals***. The graphics in **Figure 11** present the same data -- only time-phased. This allows you to better understand when the majority of requirements are generated to compare with the arrival of your capability, and also when you may need host nation support. As you can see from the graphics, a majority of the requirements occur during the third time period from C+20 - C+29. Looking at the distribution of skills over time we see that vertical and general skills dominate at the beginning of the scenario, but as forces arrive in the regions and expedient beddown requirements increase, horizontal construction skills and general labor hours take over. Should we be looking to lease equipment and hire local labor early on? Do we need more Army construction support companies or Air Force Red Horse squadrons or Navy runway repair companies on the TPFDL?



	Service	Priority 1	Priority 2	Priority 3	Total
Region 1	1	1,600	2,950	3,400	7,950
	2	1,200	2,350	4,200	7,750
Region 2	1	1,650	1,450	1,100	4,200
	2	1,050	2,350	2,300	5,700

Figure 10. SAMPLE GRAPHIC DISPLAYS OF REQUIREMENTS DATA BY GROUP TOTALS

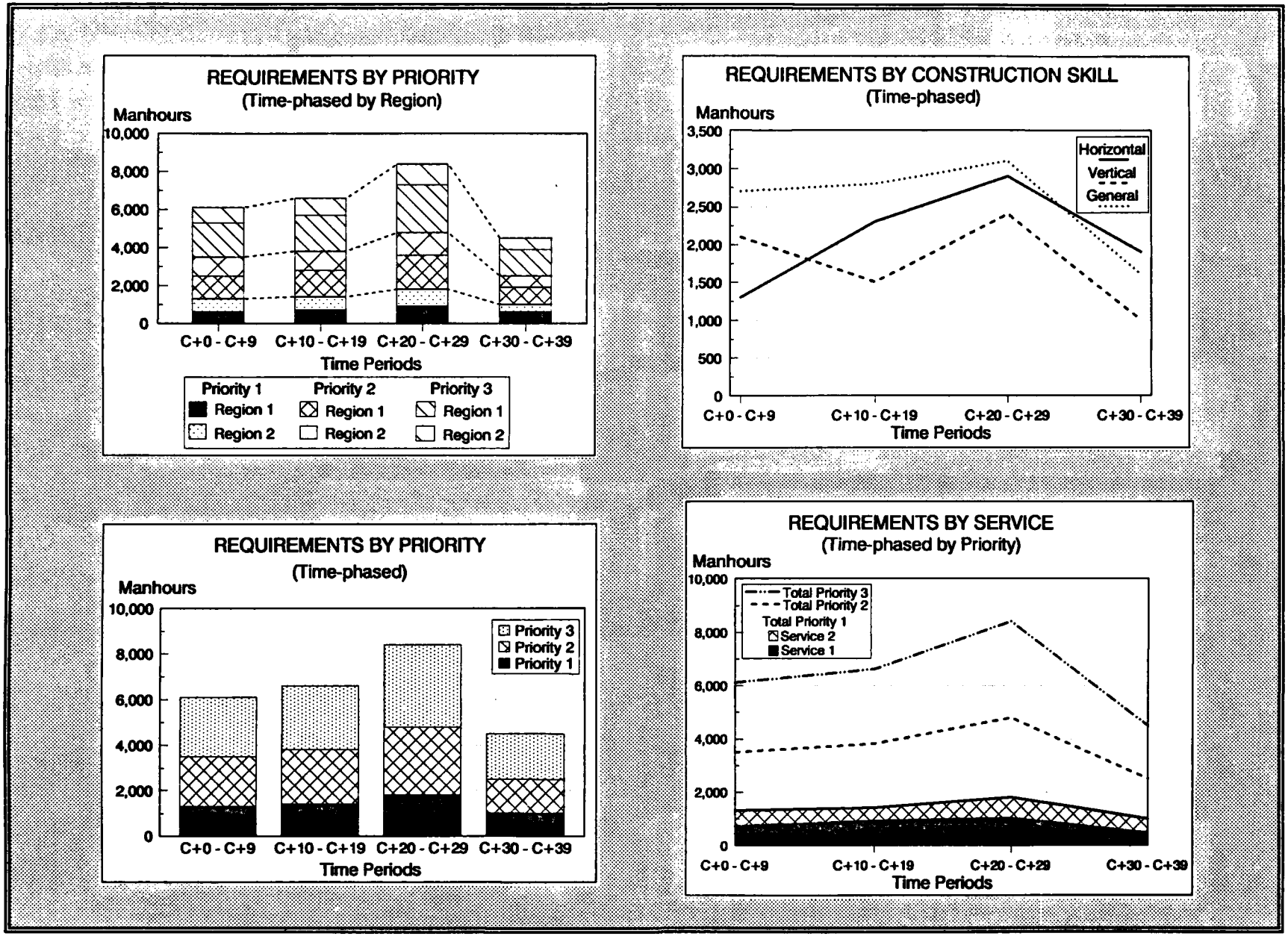


Figure 11. SAMPLE GRAPHIC DISPLAYS OF TIME-PHASE REQUIREMENTS TOTALS

(3) ***Tabular Displays.*** Since I am an analyst by trade, I can't just look at the data in all these pretty graphs, so I've included some tabular displays in **Figure 12** that are used to support the graphics. Both displays place the data into a spreadsheet and do some simple percentage calculations to show you what the driving factors are and when they occur.

(a) For example, in the first table the dominant task increment overall is increment 5 which consumes 43 percent of the total manhours. Within Priority 2, increment 3 generates 62 percent of the Priority 2 requirements. On the second half of the table are figures that show how the priorities are generated over time. On the average, you would need 138 hours of engineer capability per day to meet all the Priority 1 requirements, which consume 22 percent of all the requirements. In time period C+0 - C+9, 24 percent of all the Priority 1 requirements are generated (Percent by Column), and they account for 22 percent of all the requirements in that period (Percent by Row).

(b) In the second table, Total Manhours by Region, the data is broken into regions and services. The percentages account for a service's requirements in each region when compared with the total requirement of 26,600 manhours, the total for a given priority (6,600 for Priority 1), the percentage that service requires of the total 26,600 hours (regardless of region), and the percent that service has of the priority (again regardless of region).

(c) Just another reminder, these type of displays can be applied to any combination of factors that fit your driving needs. For example, in the second table, maybe you are more interested in comparing task increments and bases rather then regions and services.

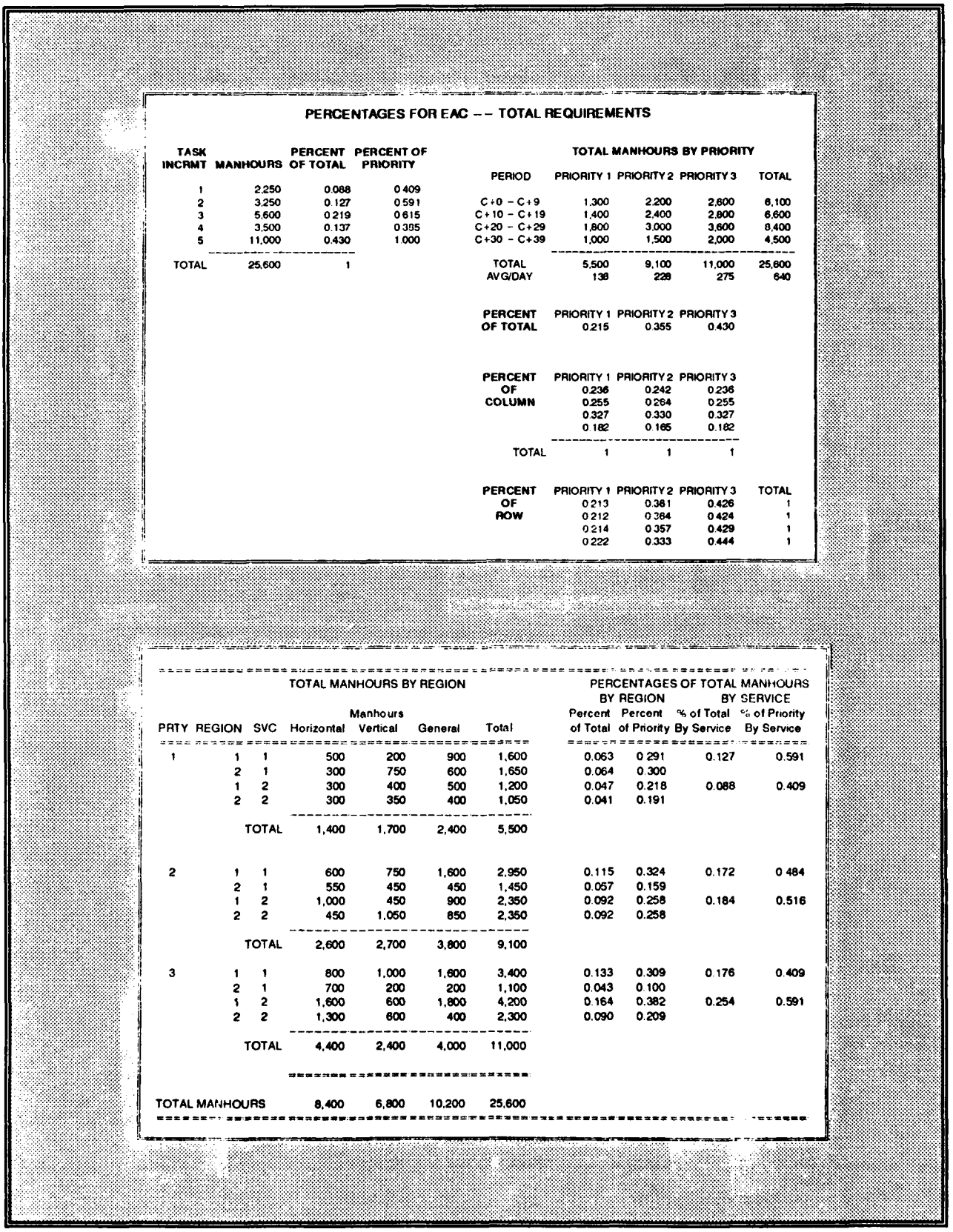
(4) ***Other Displays.***

(a) A complaint you will hear constantly as you work the CESPG is that it generates requirements engineers will never do or will never have enough force structure to accomplish. Well, one way to quell those complaints is to look at your data according to the philosophy that engineers will only do top priority tasks, and within those top priority tasks, they will only supply the skilled labor. This falls in line with several things --

- **First**, the definition of your priorities. Normally you make Priority 1 tasks your warstoppers, the second level of priority tasks are usually defined as being critical to the success of the OPLAN and therefore performed as required. Anything after that can be postponed until later in the scenario.

- **Second**, the structure of your units. Engineer units in all services have been trimmed of what we call general or unskilled labor. This type of support is expected to come from the unit the engineers are supporting, or from other sources, such as local labor.

(b) With these things in mind, you can construct a series of graphs like those shown in **Figure 13**. This reduces your requirements down to perhaps a more reasonable estimate for engineer force structure issues. It also demonstrates the importance of finding other sources of labor to accomplish the tasks that have been eliminated from engineer unit capability, but are still required to support the deploying forces.



PERCENTAGES FOR EAC -- TOTAL REQUIREMENTS

TASK INCRMT	MANHOURS	PERCENT OF TOTAL	PERCENT OF PRIORITY
1	2,250	0.088	0.409
2	3,250	0.127	0.591
3	5,600	0.219	0.615
4	3,500	0.137	0.385
5	11,000	0.430	1.000
TOTAL	25,600	1	

TOTAL MANHOURS BY PRIORITY

PERIOD	PRIORITY 1	PRIORITY 2	PRIORITY 3	TOTAL
C+0 - C+9	1,300	2,200	2,600	6,100
C+10 - C+19	1,400	2,400	2,800	6,600
C+20 - C+29	1,800	3,000	3,600	8,400
C+30 - C+39	1,000	1,500	2,000	4,500
TOTAL	5,500	9,100	11,000	25,600
AVG/DAY	138	228	275	640

PERCENT OF TOTAL	PRIORITY 1	PRIORITY 2	PRIORITY 3
	0.215	0.355	0.430

PERCENT OF COLUMN	PRIORITY 1	PRIORITY 2	PRIORITY 3
	0.236	0.242	0.236
	0.255	0.264	0.255
	0.327	0.330	0.327
	0.182	0.165	0.182
TOTAL	1	1	1

PERCENT OF ROW	PRIORITY 1	PRIORITY 2	PRIORITY 3	TOTAL
	0.213	0.361	0.426	1
	0.212	0.364	0.424	1
	0.214	0.357	0.429	1
	0.222	0.333	0.444	1

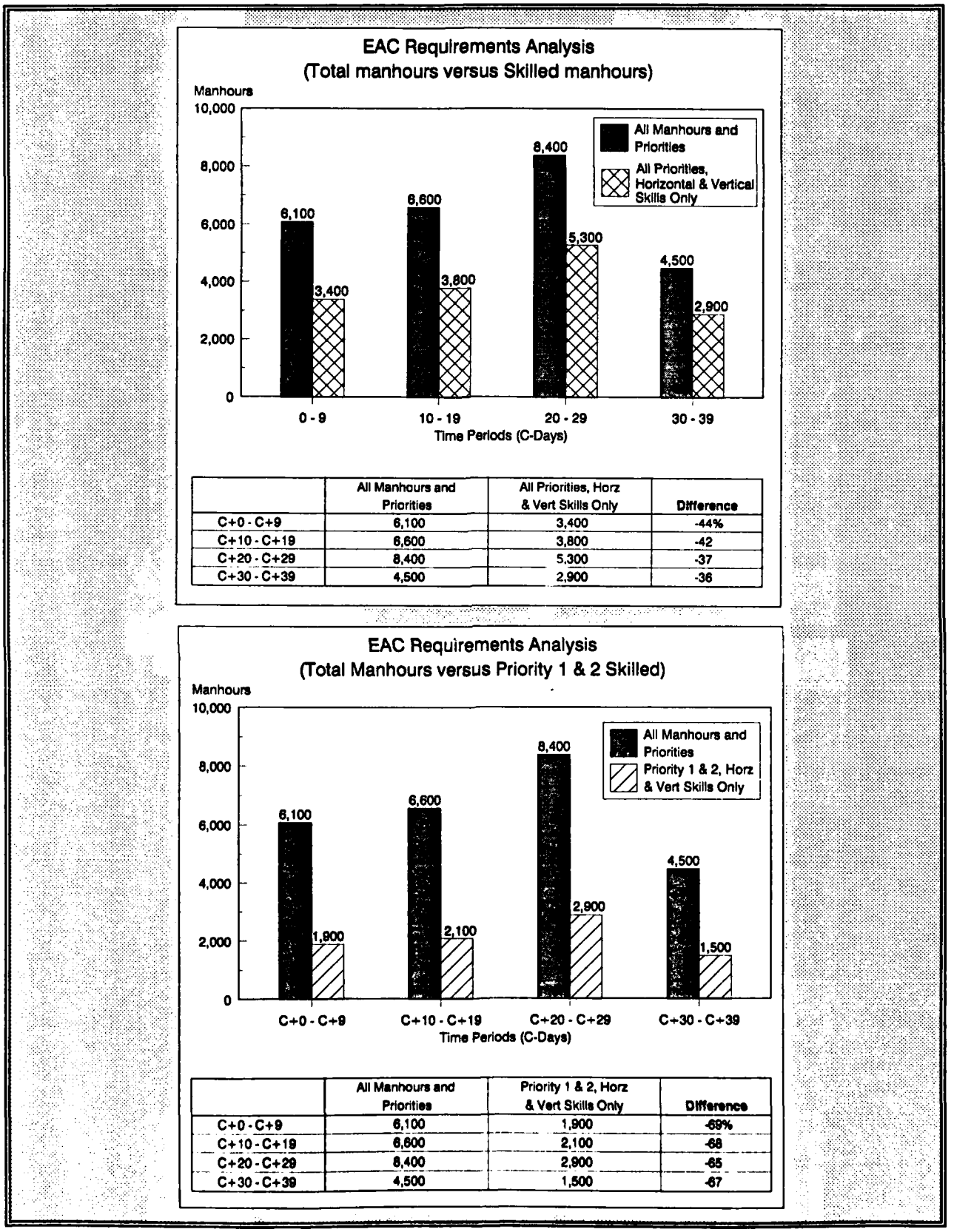
TOTAL MANHOURS BY REGION

PRTY	REGION	SVC	Manhours Horizontal	Vertical	General	Total
1	1	1	500	200	900	1,600
	2	1	300	750	600	1,650
	1	2	300	400	500	1,200
	2	2	300	350	400	1,050
	TOTAL		1,400	1,700	2,400	5,500
2	1	1	600	750	1,600	2,950
	2	1	550	450	450	1,450
	1	2	1,000	450	900	2,350
	2	2	450	1,050	850	2,350
	TOTAL		2,600	2,700	3,800	9,100
3	1	1	800	1,000	1,600	3,400
	2	1	700	200	200	1,100
	1	2	1,600	600	1,800	4,200
	2	2	1,300	600	400	2,300
	TOTAL		4,400	2,400	4,000	11,000
TOTAL MANHOURS			8,400	6,800	10,200	25,600

PERCENTAGES OF TOTAL MANHOURS

PRTY	REGION	SVC	BY REGION Percent of Total	Percent of Priority	BY SERVICE % of Total By Service	% of Priority By Service
1	1	1	0.063	0.291	0.127	0.591
	2	1	0.064	0.300		
	1	2	0.047	0.218	0.088	0.409
	2	2	0.041	0.191		
2	1	1	0.115	0.324	0.172	0.484
	2	1	0.057	0.159		
	1	2	0.092	0.258	0.184	0.516
	2	2	0.092	0.258		
3	1	1	0.133	0.309	0.176	0.409
	2	1	0.043	0.100		
	1	2	0.164	0.382	0.254	0.591
	2	2	0.090	0.209		

Figure 12. SAMPLE TABULAR DISPLAYS OF REQUIREMENTS DATA



	All Manhours and Priorities	All Priorities, Horz & Vert Skills Only	Difference
C+0 - C+9	6,100	3,400	-44%
C+10 - C+19	6,600	3,800	-42
C+20 - C+29	8,400	5,300	-37
C+30 - C+39	4,500	2,900	-36

	All Manhours and Priorities	Priority 1 & 2, Horz & Vert Skills Only	Difference
C+0 - C+9	6,100	1,900	-69%
C+10 - C+19	6,600	2,100	-68
C+20 - C+29	8,400	2,900	-65
C+30 - C+39	4,500	1,500	-67

Figure 13. SAMPLE REQUIREMENTS ANALYSIS

(c) Finally, if you want a quick way to provide the decision maker with a large quantity of information in one place, you might consider doing something similar to the graphic in **Figure 14.** This is a summary of the data for our sample CESPG run. All the data presented in this graphic can be found in either the figures that preceded it, or in the tables in *Annex B.* This provides a quick "snap-shot" approach, which shows the total requirements for your area of concern, the break-out by service, the manhours it would take to meet those requirements, an overview of the Priority 1 "war-stopper" tasks, and general summary information regarding other things of interest such as construction skills required and the most prevalent tasks.

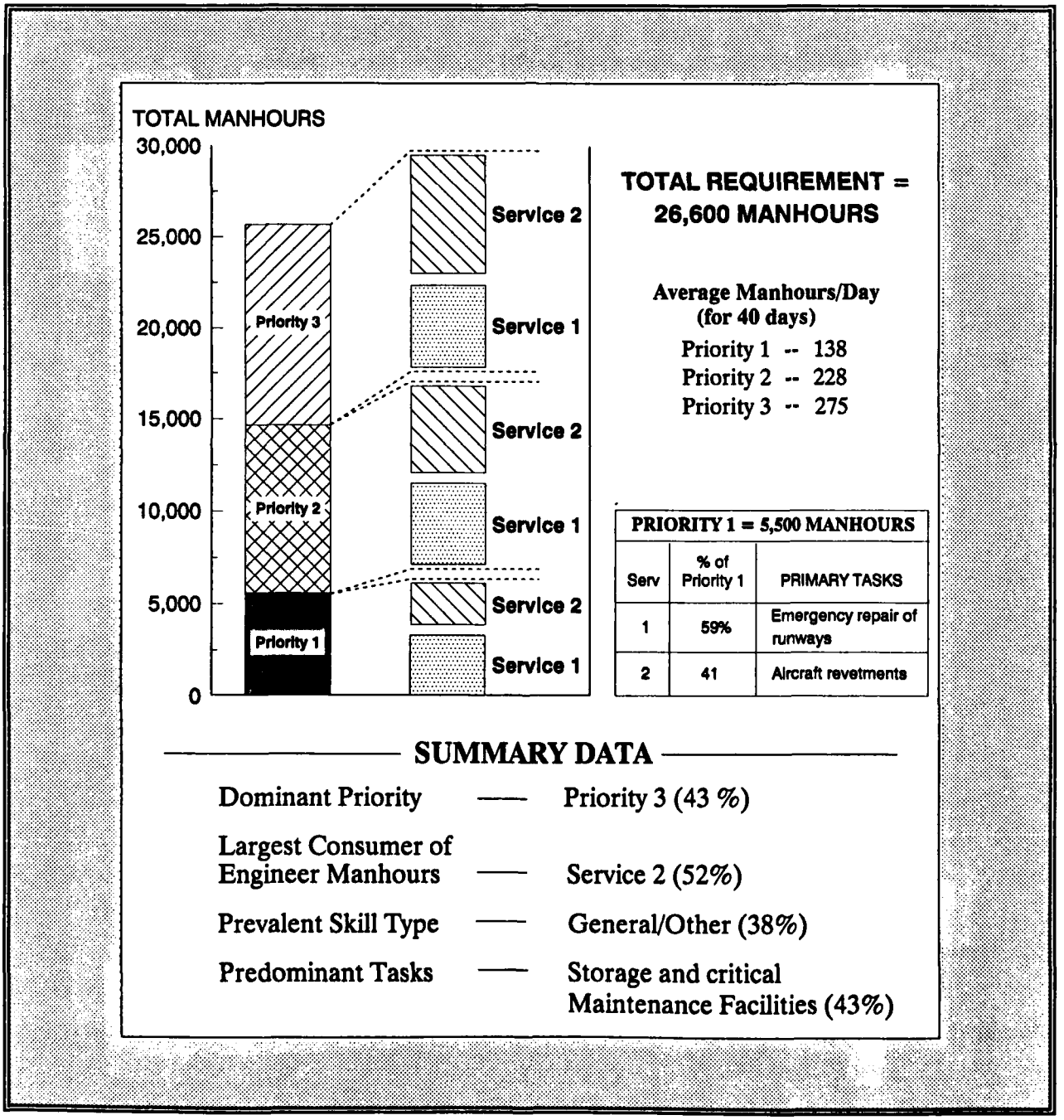


Figure 14. SAMPLE REQUIREMENTS SUMMARY GRAPHIC

c. **Capabilities Analysis.** The engineer unit capability values found in the CESPG are provided by your service representative down at the Pentagon. These estimates are for standard design units, and do not reflect the actual capability of modified units. As mentioned previously, the CESPG model comes complete with a scheduler module that takes the engineer capability available in the theater and places it against the requirements. However, several problems have been found with this process, which have led most of the CESPG community to discount its results. Also, I don't believe that scheduling engineer capability on a project-by-project basis for a theater-level analysis provides a realistic picture of the engineer's ability to support the OPLAN. I work under the philosophy that what you want to find out is; do I have enough engineers to perform my Priority 1 war-stoppers within the theater as a whole and can they be where they're needed when they're needed? The graphics in **Figure 15** show some different means of showing how capability compares with the requirements. These methods give you a feel for where your problem areas exist, both in a time-period-by-time-period snap-shot and cumulatively.

(1) ***Time-Period Snapshots.*** To determine if our engineer force structure can meet the requirements, I've developed a simplistic approach that looks at the deployed capability by construction skill, and matches it against the prioritized groups of requirements over time. The table at the top of **Figure 16** shows what happens with our example data. The capability values are listed in *Annex B.*

(a) For this particular example we're looking at manhours required and available on a daily basis. You can perform this same analysis using total manhours for each time period if that better suits your needs. The first column of values lists the manhours required during each time period for each priority. The last column lists the available capability in the theater during those same time periods. The middle column shows the results of matching these two and is interpreted as follows:

- Looking at the available horizontal capability in time period C+0 - C+9 (10 manhours per day), it is first applied to the Priority 1 requirement of 20 manhours per day, leaving a shortfall of 10 manhours per day in the middle column for that time period.

- Since there is not enough horizontal capability to meet the horizontal requirement for Priority 1, there isn't enough to meet Priority 2 or 3 requirements for that same time period either.

- Therefore, if you look at the values for Priority 2 and 3, you see that the shortfall accumulates so that in time period C+0 - C+9, we have a shortfall of 50 manhours per day if you wish to meet both your Priority 1 and 2 requirements, and a shortfall of 120 manhours per day if you wanted to meet all three priorities.

- When there is excess capability (shown by negative numbers in parenthesis), that excess capability is applied to the requirements at the next priority level for that time period.

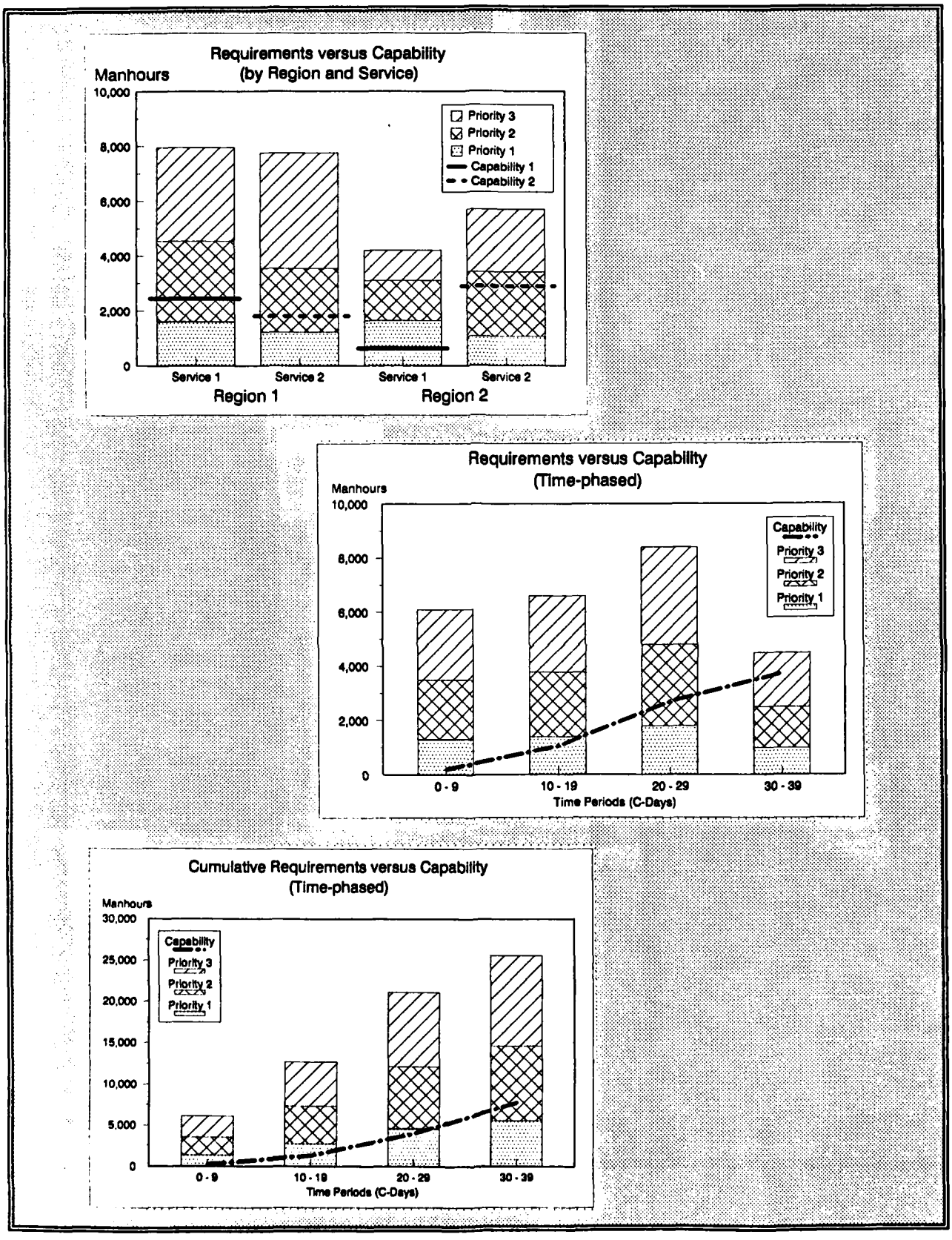


Figure 15. SAMPLE CAPABILITY VERSUS REQUIREMENTS GRAPHICS

	Period (C-Days)	MANHOURS REQUIRED (Daily average) Horz	Vert	Other	Total	MANHOUR SHORTAGE (Negative values = excess) Horz	Vert	Other	Total	SHORTAGE OF ENGINEER CAPABILITY (Shown in Percent) Horz	Vert	Other	Total
Priority 1	0 - 9	20	50	60	130	10	45	55	110	50%	90%	92%	85%
	10 - 19	40	40	60	140	(10)	5	40	35	---	13%	67%	25%
	20 - 29	50	60	70	180	(60)	(40)	10	(90)	---	---	14%	---
	30 - 39	30	20	50	100	(110)	(125)	(40)	(275)	---	---	---	---
		Horz	Vert	Other	Total	Horz	Vert	Other	Total	Horz	Vert	Other	Total
Priority 2	0 - 9	40	80	100	220	50	125	155	330	125%	156%	155%	150%
	10 - 19	70	60	110	240	60	65	150	275	86%	108%	136%	115%
	20 - 29	90	90	120	300	30	50	130	210	33%	56%	108%	70%
	30 - 39	60	40	50	150	(50)	(85)	10	(125)	---	---	20%	---
		Horz	Vert	Other	Total	Horz	Vert	Other	Total	Horz	Vert	Other	Total
Priority 3	0 - 9	70	80	110	260	120	205	265	590	171%	256%	241%	227%
	10 - 19	120	50	110	280	180	115	260	555	150%	230%	236%	198%
	20 - 29	150	90	120	360	180	140	250	570	120%	156%	208%	158%
	30 - 39	100	40	60	200	50	(45)	70	75	50%	---	117%	38%
EAC TOTAL		Horz	Vert	Other	Total	Horz	Vert	Other	Total	Horz	Vert	Other	Total
	0 - 9	130	210	270	610	120	205	265	590	92%	98%	98%	97%
	10 - 19	230	150	280	660	180	115	260	555	78%	77%	93%	84%
	20 - 29	290	240	310	840	180	140	250	570	62%	58%	81%	68%
	30 - 39	190	100	160	450	50	(45)	70	75	26%	---	44%	17%
DAILY AVERAGE		210	175	255	640	133	104	211	448	63%	59%	83%	70%

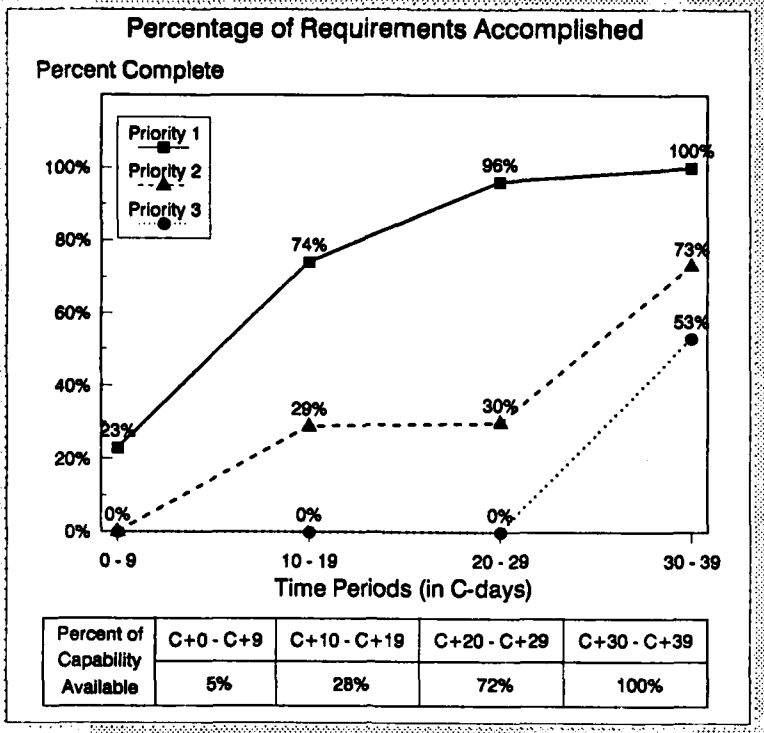
	Period (C-Days)	MANHOURS REQUIRED (Daily average) Horz	Vert	Other	Total	MANHOUR SHORTAGE (Negative values = excess) Horz	Vert	Other	Total	ENGINEER CAPABILITY (Daily average) Horz	Vert	Other	Total
Priority 1	0 - 9	20	50	60	130	10	45	55	110	10	5	5	20
	10 - 19	40	40	60	140	(10)	5	40	35	50	35	20	105
	20 - 29	50	60	70	180	(60)	(40)	10	(90)	110	100	60	270
	30 - 39	30	20	50	100	(110)	(125)	(40)	(275)	140	145	90	375
		Horz	Vert	Other	Total	Horz	Vert	Other	Total				
Priority 2	0 - 9	40	80	100	220	50	125	155	330				
	10 - 19	70	60	110	240	60	65	150	275				
	20 - 29	90	90	120	300	30	50	130	210				
	30 - 39	60	40	50	150	(50)	(85)	10	(125)				
		Horz	Vert	Other	Total	Horz	Vert	Other	Total				
Priority 3	0 - 9	70	80	110	260	120	205	265	590				
	10 - 19	120	50	110	280	180	115	260	555				
	20 - 29	150	90	120	360	180	140	250	570				
	30 - 39	100	40	60	200	50	(45)	70	75				
EAC TOTAL		Horz	Vert	Other	Total	Horz	Vert	Other	Total				
	0 - 9	130	210	270	610	120	205	265	590				
	10 - 19	230	150	280	660	180	115	260	555				
	20 - 29	290	240	310	840	180	140	250	570				
	30 - 39	190	100	160	450	50	(45)	70	75				
DAILY AVERAGE		210	175	255	640	133	104	211	448				

Figure 16. SAMPLE CAPABILITIES ANALYSIS TABLES

(b) This method presents the shortfalls or excesses in capability only within a given time period, and does not accumulate the data over time. This is only appropriate for scenarios where you can pick time periods that are largely "independent," without a lot of tasks that carryover from period-to-period. This would be the case if you have an OPLAN with very different and distinct phases in which jobs not accomplished in one phase are "overtaken by events" in the next phase. This method provides you with a means to look at the flow of your force structure over time, and adjust it accordingly to meet the majority of your top priority requirements by changing the capability numbers and recalculating the spreadsheet. It also allows you an opportunity to check the balance of construction skills required versus those available. Shortfalls may either call for different types of units, or raise a flag highlighting the need for host nation support.

(c) The second table on the page presents the data in a different light, by taking the actual manhour shortages and translating them into percentages.

(d) Another means of viewing the requirements is shown in **Figure 17**. Here I've displayed how the requirements are accomplished over time. For example, 23 percent of the Priority 1 tasks are completed during the first time period, while none of the Priority 2 or 3 requirements are handled. During the second time period (C+10 - C+19) 74 percent of Priority 1 tasks, 29 percent of Priority 2 and none of the Priority 3 tasks have been accomplished. The table that accompanies the chart shows how the data breaks down by the various construction skills.



Percent of Capability Available	C+0 - C+9	C+10 - C+19	C+20 - C+29	C+30 - C+39
	5%	28%	72%	100%

		MANHOURS REQUIRED (Daily average)				MANHOURS FULFILLED (In percents)			
	Period (C–Days)	Horz	Vert	Other	Total	Horz	Vert	Other	Total
Priority 1	0 – 9	20	50	60	130	50%	10%	8%	23%
	10 – 19	40	40	60	140	100%	88%	33%	74%
	20 – 29	50	60	70	180	100%	100%	86%	95%
	30 – 39	30	20	50	100	100%	100%	100%	100%
		Horz	Vert	Other	Total	Horz	Vert	Other	Total
Priority 2	0 – 9	40	80	100	220	0%	0%	0%	0%
	10 – 19	70	60	110	240	86%	0%	0%	29%
	20 – 29	90	90	120	300	33%	56%	0%	30%
	30 – 39	60	40	50	150	100%	100%	20%	73%
		Horz	Vert	Other	Total	Horz	Vert	Other	Total
Priority 3	0 – 9	70	80	110	260	0%	0%	0%	0%
	10 – 19	120	50	110	280	0%	0%	0%	0%
	20 – 29	150	90	120	360	0%	0%	0%	0%
	30 – 39	100	40	60	200	50%	100%	0%	50%
EAC TOTAL		Horz	Vert	Other	Total	Horz	Vert	Other	Total
	0 – 9	130	210	270	610	8%	2%	2%	4%
	10 – 19	230	150	280	660	22%	23%	7%	17%
	20 – 29	290	240	310	840	38%	42%	19%	33%
	30 – 39	190	100	160	450	74%	100%	56%	77%
DAILY AVERAGE		210	175	255	640	37%	41%	17%	32%

Figure 17. SAMPLE USING PERCENTAGE OF REQUIREMENTS ACCOMPLISHED

(2) ***Cumulative Viewpoint.*** The final set of methods I'm going to show you takes the same data used in the "Snap-shot" analysis and accumulates it over time rather then looking at it time-period-by-time-period. This method is based on the assumption that if a task is generated, then it's needed. If it cannot be accomplished during that time period, the requirement doesn't go away, but continues in a holding pattern, i.e., it is carried over into the next time period and so forth until enough assets are available to accomplish the requirement.

(a) The table in **Figure 18** shows the data used to create these cumulative graphics.

Time Periods (C–DAYS)	Cumulative Capability	Cumulative Manhours Required Priorities			Manhours Accomplished Priorities			Manhours NOT Accomplished Priorities		
		1	2	3	1	2	3	1	2	3
0–9	200	1300	2200	2600	(200)	0	0	1,100	2,200	2,600
10–19	1,260	2700	4600	5400	(1,060)	0	0	1,440	4,600	5,400
20–29	3,960	4500	7600	9000	(2,700)	0	0	540	7,600	9,000
30–39	7,720	5500	9100	11000	(1,540)	(2,220)	0	0	6,880	11,000

Figure 18. DATA TABLE OF CUMULATIVE CAPABILITY VERSUS REQUIREMENTS

(b) The top graphic in **Figure 19**, on page 30, is called the "floating bar chart". The area above the "0" line shows the requirements not accomplished as they accumulate over time. The area below the "0" line represents the requirements completed given the capability. As you can see, you never get your Priority 1 war-stopper tasks done until C+39. To accomplish these tasks you can either argue to move your engineers forward on the TPFDL, or negotiate for increased host nation or contract support to cover the early stages of the conflict.

(c) The graphic on the bottom shows the same data in a more conventional method. The cumulative capability hours are shown side-by-side with the cumulative requirements. It's important to note that both of these examples assume capability and requirements are devoid of construction skill differences. You can do the same thing with breakdowns by skill, region, service, etc.

13. **SUMMARY.** The past several pages have provided you with an entire series of graphs and tables that I've used over the course of three engineer assessments. Our sponsors have told me that the analysis of their CESPG data has resulted in better use of their limited engineer assets. I hope you are able to find something in this array of possibilities that meets your needs.

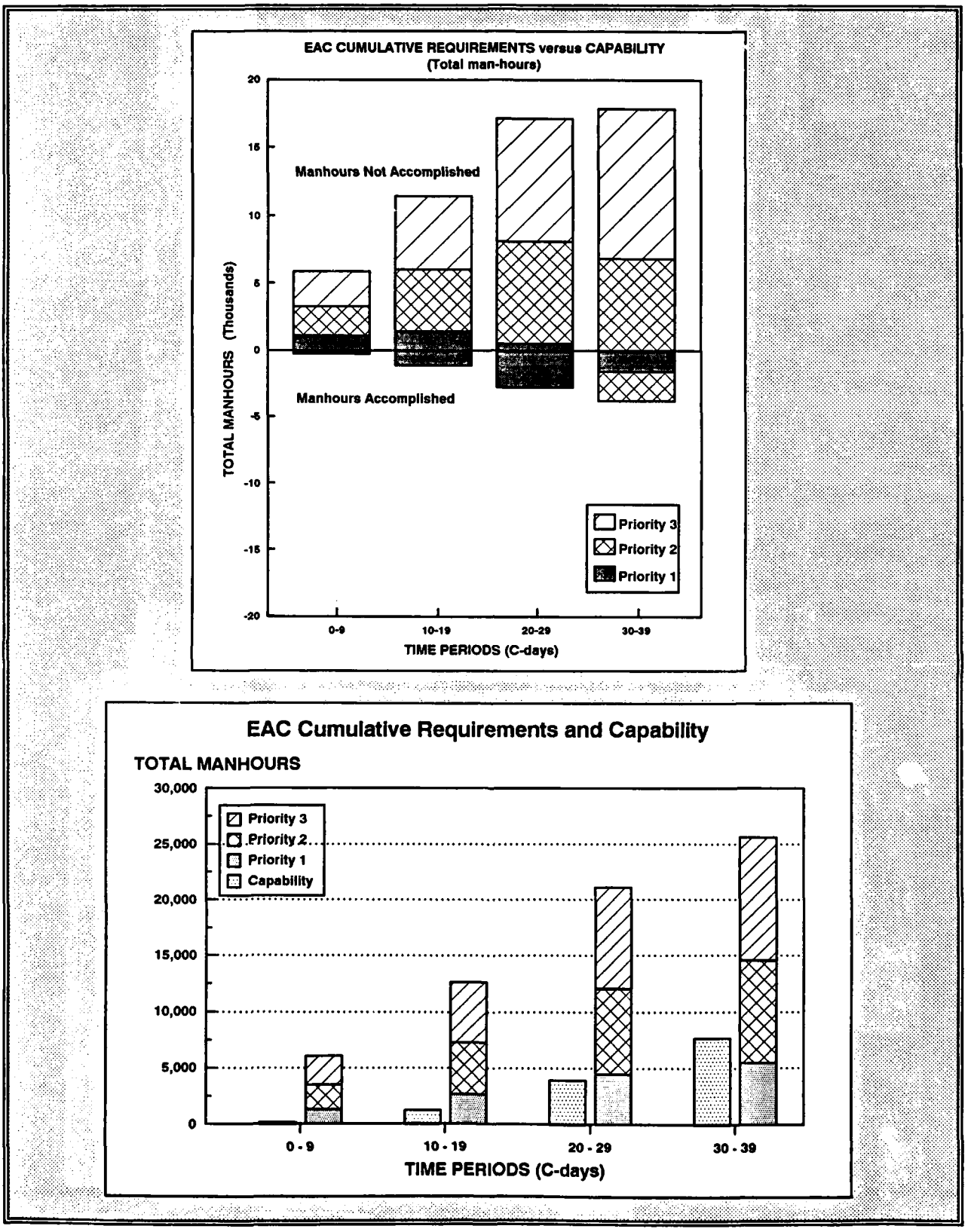


Figure 19. SAMPLE CUMULATIVE DISPLAYS OF REQUIREMENTS VERSUS CAPABILITIES

LAST PAGE OF MAIN PAPER

ANNEX A:

CESPG DATA FILES

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ANNEX A

CESPG DATA FILES

INTRODUCTION

This annex provides a description of the various data files that make up the CESPG. Along with a graphic display of the update output listing, I've included a brief narrative description of the files and a series of questions and answers. The questions and answers will give you an idea of:

- what each data element in the file is for
- why you need to be concerned about it
- what impact it has on the output
- how it relates to other data elements found in other files

In some cases I've also written a section called "Tidbits" to give you information about the file that isn't necessarily found in the current manuals, or is so buried that only the most die-hard user would find it.

One of the biggest problems when updating information in these data files is the close relationship of certain data elements between one file and another. We often think that making a change in one file concludes our effort, but this may not be the case. For example, we find that the unit of measure is a linking data element in five different files. When you change the unit of measure in one file you must check the four remaining files for any effects. **Figure A-1** lists the eight common data elements, where they are defined, and the other files in which they are found.

To show how and when to use each file I've included a series of four graphics in the Appendix to this annex. These graphics represent the flow of the model. An annotation of what is being extracted or being created at each step is found next to its flow chart symbol.

FILE DESCRIPTIONS

COMPONENT DEFINITION FILE

COMPONENT DEFINITION FILE
(BY SERVICE, COMPONENT)

FACILITY CMPNT CODE	SVC CODE	COMPONENT DESCRIPTION	CMPNT SIZE	UNIT OF MEAS	WHOLE/ FRACT CODE	COST (IN HUNDREDS OF DOLLARS)	SHORT TONS	MEAS. TONS	HORZ M-H/ DAY	VERT M-H/ DAY	OTHER M-H/ DAY	DAYS	JCS CATEGORY CODE	FOLLOW-ON COMPONENT CODE	DELAY DAYS	DELAY CONST SVC
11150AA	A	RUNWAY FIXED WING	1000	SY	F	85	34	21	2	—	58	1	111AB	——	—	-
11100WD	N	RRR FXD WING RUNWAY	9	EA	F	6839	132	389	153	18	270	1	111AW	——	—	-
21801FB	F	SHOP TENT REVETED	4000	SF	W	262	44	39	225	22	49	5	216AB	21102AC	90	A
15160P	M	600 LF PIER	1200	FB	F	8063	982	1522	198	466	0	55	151CC	——	—	-

Of all the files, the components file has the greatest influence over the results. This file contains all data relating to: how many manhours it takes to construct a standard-sized facility; the number of days to construct it; the cost of the materials; and the weight and cube of the materials (in short and measured tons). Having the correct components in this file is critical to getting credible output to perform further analysis of engineer requirements versus capability.

The data are grouped into three tiers:

The **first** tier is selected by the Joint Chiefs of Staff (JCS) category code (CATCODE). This is a four-digit representation consisting of three numbers and a letter. These CATCODES and what type of facility they represent are found in Memorandum from the Joint Chiefs of Staff (MJCS) 275-89 *Planning Factors for Military Construction in Contingency Operations.*[1] For example, all depot level fuel storage is given a "411" coding, the type of fuel to be stored is coded by the fourth letter: 411C is diesel, 411D is MOGAS, 411E is JP-4, etc.

The **second** tier is selected by the type of construction. This is a fifth digit that is added to the JCS CATCODE to denote the differences between beddown/initial standard facilities and is represented by a "B." Temporary or higher standards of construction are represented by a "C." Emergency war-damage repair to existing facilities is represented by a "W." An "R" represents a more deliberate/higher standard of damage repair termed "restoration."

[1] "*Planning Factors for Military Construction in Contingency Operations*", Memorandum from the Joint Chiefs of Staff (MJCS-0275-89), 13 December 1989.

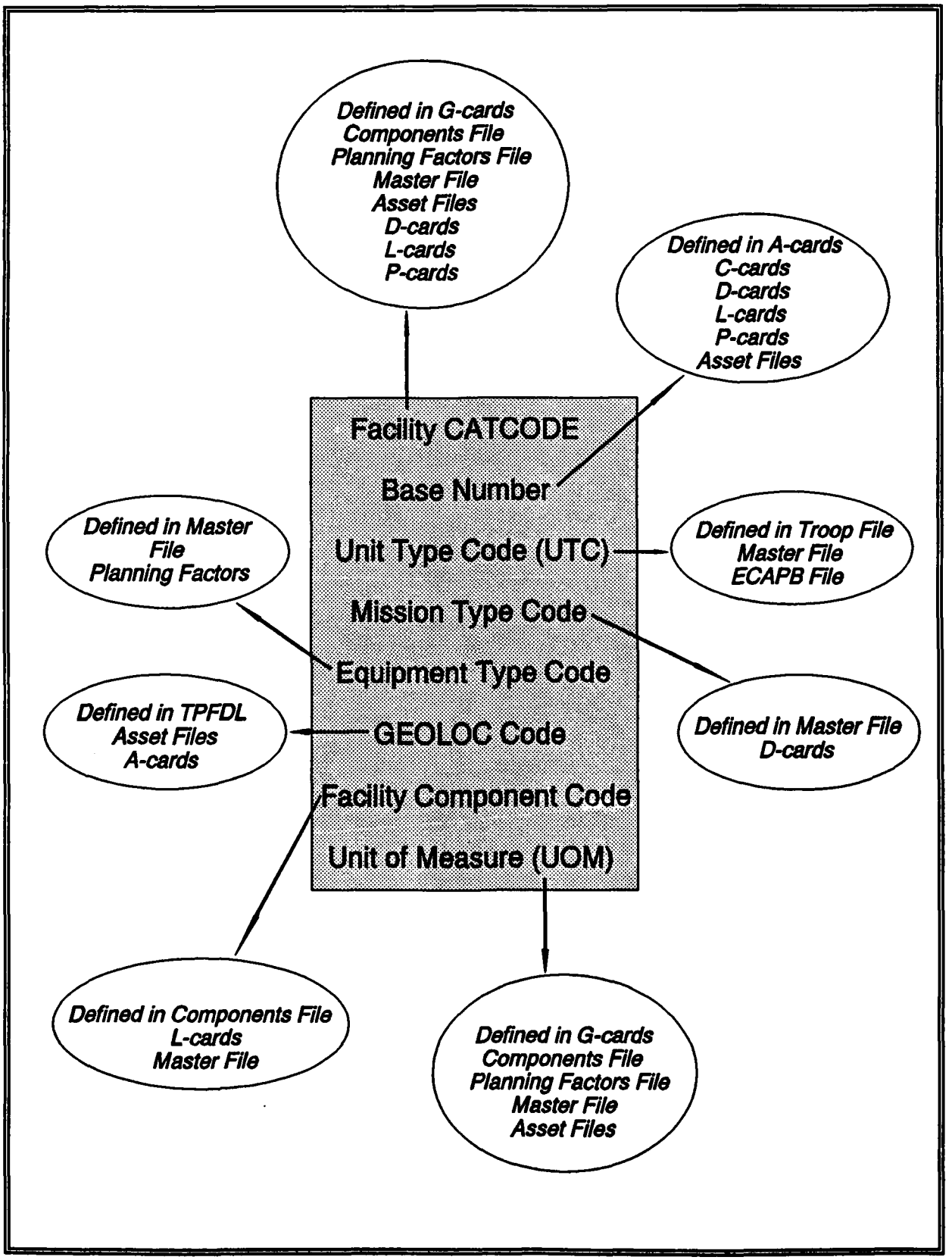

Figure A-1. RELATIONSHIP OF DATA ELEMENTS AND FILES

The **third** and final tier is decided by the individual facility code. This allows you, the planner, to have multiple sizes of facilities available for the model to select (for example covered storage codes for 1,000, 2,000, and 5,000 square feet). You may also want to provide a selection of facilities that are constructed from different types of material. The facility code for the Army is taken from Technical Manual (TM) 5-301 *Army Facilities Component System.*[2] The facility code for the Navy and the Marine Corp is taken from Advanced Base Functional Component System (ABFCS) Naval Facilities Engineer Command (NAVFAC) P-437 *Facilities Planning Guide (Volume 2).*[3] The Air Force Engineering Services Center (AFESC) at Tyndall AFB develops estimates for the Air Force.

Why is it necessary to have varying sizes for a single category code?

The answer lies at the core of the model's logic. Recall that a majority of the requirements are generated by planning factors. Often, these factors when multiplied by the number of personnel/aircraft/units arriving at a base location result in a fractional number of square feet/square yards/etc. Having a range of facility sizes to select from allows the model to select the one closest to the requirement. For example, if at base XYZ you need 750 square feet of covered storage at day 10, the model will select the manhours associated with constructing the 1,000 square foot facility. If another 4,700 square feet is needed at day 20, the model will select the 5,000 square foot facility manhours. This allows you, as the planner, to provide for the economies of scale usually found in construction. To account for the fractions (i.e., 4,700 versus 5,000, the model simply takes the percentage of the manhours, tonnage, and costs based on the ratio of the requirement to the standard size (here it would be 4,700/5,000 = .94).

Why have components that represent construction of the same facility but use different types of materials?

Most often this would occur when you move from beddown/initial standards to higher standards. However, you must be aware that the data that exists in the file may not represent the type of construction dictated by your CINC. Why? The file is generated from guidance provided by each of the service representatives located in the Pentagon. The components they select reflect age-old standards. For example, a majority of all the Army "C" components use wood-frame construction values for manhours, materials, and cost. This created a problem during some recent Desert Shield analysis when the CINC guidance was that temporary "C" construction components would represent light-weight steel frame construction. As a result, the planners had to review the TM 5-301 documents to ensure that the light-weight steel frame costs, tonnages, and manhours were included in the file. Looking at initial standard "B" components, differences between theaters may result in a need to review some data. In Southwest Asia, "B" initial construction standards may consist of tents with liners, resulting in no additional flooring requirement. In contrast, initial standard "B" in South America may require some type of flooring because of the damp/muddy conditions found in the region.

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[2] *Army Facilities Components System (U)*, TM 5-301 (DA, U.S. Army Corps of Engineers, Office of the Chief of Engineers, Huntsville Division, 2 August 1989).

[3] *Facilities Planning Guide (Volume 2)*, P-437, (Naval Facilities Engineering Command (NAVFAC), January 1987).

How do you know if your components file is structured properly?

All facilities listed with a five-digit JCS CATCODE ending with a "B" (for beddown) should be initial standards. All those JCS CATCODES ending with a "C" (for construction) should be temporary standards. How can you easily tell the difference? The manhours for beddown "B" category code facilities should be considerably less then the manhours for the "C" category coded facilities. The same is true for "W" (emergency war damage repair) versus "R" (restoration).

What if you find the entries do not fit this general trend?

If you are an **Army** planner you need to have a copy of the *Army Facilities Component System* (AFCS) in your office. This is the "facilities bible" and provides you with manhours to construct, short-tons/measured tons of material needed, and cost information. You can refer to this document, along with the many supplementary guides available from the Huntsville District to check manhours against your data file. I suggest you get on their mailing list, as supplements are released when facility designs are finalized. A version of the AFCS system has been automated for use with the PC-based Theater Army Construction Automated Planning System (TACAPS). Both these items can be ordered through:

COMMANDER
U.S. Army Engineer Division, Huntsville (USAEDH)
ATTN: AFCS (CEHND-ED-SY)
P.O. Box 1600, Huntsville, AL 35807-4301

Navy and **Marine Corps** planners have a similar document known as the *Advanced Base Functional Component System* (ABFCS). This publication contains the same general information as the Army's AFCS documents and can be ordered through the Naval Publications and Forms Center. The Navy has recently automated the ABFC system for use on IBM-compatible PCs. Planners can request the computerized version by contacting:

Naval Construction Battalion Center
Code 1521, ATTN: Ms. Judy Paulson
Pleasant Valley Road
Port Hueneme, CA 93043

Air Force planners do not have a publication to refer to for this type of data at this time. The Air Force Engineering Services Center (AFESC) is responsible for the development of facility manhours and material requirements. Air Force planners can either contact AFESC directly with questions, or adopt an Army or Navy facility component that best fits their needs. You can contact AFESC at:

Headquarters
Air Force Engineering Service Center (AFESC)
ATTN: DEO (Dick Jamieson)
Tyndall AFB, FL 32403

Tidbits.

Planners have the ability to change any data in the file. You can add components that may be unique to your requirements (an example would be a component to construct a logistics-over-the-shore site, change manhours to reflect your theater's standards, or delete facility components out of the file that don't meet your requirements).

You also have the option to designate upgrades of initial standard facilities to a temporary/higher standard for a specific CATCODE or facility component (CESPese refers to this as "follow-on construction.") This allows planners to see what the increased requirement for men and materials would be should a protracted situation develop, such as the one we saw in Desert Shield. For example, what if you wanted all billeting/berthing to move from tents to framed facilities after 180 days? How many more short-tons of material must be shipped to or acquired in the theater, and how much more manpower is needed to install those buildings? The Air Force uses this method to determine the timing and amount of Army engineer support it will need to upgrade facilities at its airbases.

PLANNING FACTORS

PLNGFCT TYPE	SVC CDE	JCS CAT CDE	SUPP STRUCT INDEX	CONST PLCY INDEX	CATEGORY CODE DESCRIPTION	UNIT OF MEAS	PLNGFCT ECHLN 1	PLNGFCT ECHLN 2	PLNGFCT ECHLN 3	PLNGFCT ECHLN 4	PLNGFCT ECHLN 5
F16	F	113A	1	01	A/C PARKING APRON	SY	1498	0	0	0	0
BYBASE	N	116C	1	04	ARM/DISARM PAD	SY	5000	0	0	0	0
PEOPLE	A	411C	2	38	DIESEL FUEL STORAGE	BL		000.3305	000.1100	001.0785	0
TOTPOP	M	730B	1	62	MP/BRIG FACTOR/S	SF	0.70	0	0	0	0

The planning factors file is possibly the second most important file to review prior to running the CESPG model. Clearly most of the requirements are generated based on factors that are either applied to the number of personnel arriving at a base location, the number and type of aircraft, or who the predominant service is at a base (referred to in CESPese as "by- base" factors). The data in this file comes from two main sources: Memorandum from the Joint Chiefs of Staff (MJCS) 275-89 *Planning Factors for Military Construction in Contingency Operations* (for all people and by-base values, and the service headquarters for individual aircraft related factors. The planning factors are given for each of 136 JCS CATCODES.

Planning factors are provided for each service and developed for universal application--they may not reflect theater specific factors. For example, the area needed for ammunition storage would vary according to the weapons and intensity of conflict expected in your theater. Fuel consumption by aircraft will vary depending on projected sortie rates. Therefore, all these factors can be adjusted by the planner. There is one catch though, any changes need to be coordinated within your own chain of command.

The factors in the file are in the following order:

Fixed wing aircraft. These factors are multiplied by the number of aircraft in a unit and account for facility support that includes: parking aprons, revetments, maintenance hangers, air or squadron operations centers, operational fuel storage, ammunition storage, and various other maintenance and support facilities directly tied to the aircraft. These do not include support to the men that operate and maintain the aircraft.

Predominant service at a base location (by-base factors). The factors generate facilities wherever a given service dominates (in CESPese it is called the "base-owner"). For example, if the base-owner is the Air Force, certain facilities such as control towers, wash racks, compass calibration pads etc. will be required. The logic here is that if the Air Force is going to operate from a given location, then at a minimum certain facilities are needed to classify it suitable for operations.

A second set of aircraft specific factors are presented that relate to rotary wing and support-role fixed wing aircraft. They contain the same types of planning factors as the first set of aircraft factors. In all there are four sets of aircraft planning factors (as you will see as you read on). I believe that the file was originally structured alphabetically so that all aircraft that begin with an *A* came before the by-base factors, etc; but over time this has idea has fallen by the wayside, resulting in a less than structured environment!

Number of arriving personnel. The next set of factors are listed as "people" and are multiplied by the number of personnel as they arrive at a base location. These factors generate facilities to store fuel, ammunition, and water; determine the space needed for open, covered, and cold storage; and develop requirements for billeting/berthing to include housing, dining, electricity, and sewage.

Total base population. The next to last set of factors is listed as "total population." These factors are only applied according to who the base-owner is. They are multiplied by the total number of personnel scheduled at a base location. The Air Force, Navy, and Marine Corps apply factors in this manner. They generate facilities for storage, medical, and police. The Army has elected not to use this format to generate facilities. The exception is that at every base location classified as "Army-owned," a communications center will be constructed.

Finally we have the last group of aircraft planning factors for those models that begin with the letter "T" through "Z." These few models include rotary wing aircraft such as the "UH" series.

Be aware of the Days of Supply (DOS). A trick to working with the planning factors in MJCS 275-89 is that they are all given as a "per day" requirement. If your theater guidance is that stockage levels will be kept at more then one day of supply (DOS), then the factors must be multiplied by that DOS. A good example is water storage. The current factors are 25 gallons per man for each service (15 gallons per man for the Marine Corps). In a remote arid region, the CINC may require that two days of supply be on hand at each base location. Therefore, the planning factor in the CESPG would be 50 gallons per man (30 for the Marine Corps).

What about varying DOS at higher echelons of support?

Another thing to keep in mind is how the logistics structure will be executed. This is a particular problem for the Army and the Marine Corps who do not operate out of fixed locations. For the Army, the amount of logistics supply stocked at each echelon varies (i.e., from unit, to division, to corps, to echelons above corps (EAC)). At each level, the Army keeps different stocks for a different DOS measure. You planners need to find out what those DOS are for various supplies that will require planning factor generated engineer construction support. Typically this includes: covered storage (classes I-II-III packaged only -IV-VI-VII-VIII-IX, open storage (classes II-III packaged only -IV-VII-IX, cold storage (classes I-VI-VIII-IX, ammunition storage (both covered and open, and fuel storage (both operational levels to be kept with the unit and diesel-MOGAS-JP storage at division-corps-EAC). MJCS 275-89 has standardized factors in it that only need to be multiplied by the DOS for those who do not wish to run a myriad of calculations. For the more ambitious, if you can possibly get your logisticians to tell you the specific consumption rates for each of the nine classes of supply (in pounds/man/day), MJCS 275-89 provides the equations for you to calculate your own theater specific factors for open, covered, and cold storage facilities.

What do the Planning Echelon Number 1,2,3,4,5 columns do for you?

This is where you place the different planning factor values you calculated above. Planning factor echelon 1 is the amount of that facility to be constructed to support operations at a base location. Echelon 2 planning factors are for the next level of support. This would equate to division/area support group (ASG) for the Army and advanced logistic support sites (ALSS) for the Navy and Marine Corps. Echelon 3 would be for a higher level (Army corps/corps support group (CSG)). Echelon 4 is the next level (Army EAC/theater army area command (TAACOM)), and echelon 5 for a level above that if needed.

What does the supply structure index refer to?

The number in this column is matched to another file called the "Cards file." Essentially this file sets up overall parameters for your theater of operations. There is a portion of it that allows the planner to designate what bases will be used by the Army for division, corps, and EAC ASG, CSG, and TAACOM depot locations; and the Navy and Marine Corps for ALSSs. Typically the Air Force does not echelon its supply. There are 5 different structures that can be designed and kept in the model. The number in this column tells the model which of those structures you wish to use. The model will create a requirement at each base designated in the supply structure index by multiplying the planning factor echelon value by the appropriate parameter (in all cases to date this is the number of people).

How do you know if your planning factors file is correct?

The only thing you can do is have your copy of MJCS 275-89, theater specific DOS guidance, and individual aircraft facility support requirements sitting next to you and go down each JCS CATCODE line-by-line. If the numbers don't match up, they will need to be changed. A word of warning--when we went to run a CESPG in support of Desert Shield in September 1990, we found that none of the MJCS 275-89 factors had been incorporated.

Tidbits.

You will also see guidance in MJCS 275-89 stating that for some factors, the factor is derived through "planner analysis" or "as required." What this translates to in reality is that without you providing a planning factor, the facility will not be generated as a requirement by the model. You as the planner are responsible for finding out if, in fact, this support is needed by contacting the command units that would generate that type of facility. An example is installation of POL pipelines. The Army engineer planner has to contact the quartermaster command unit to find out if pipelines are planned. If they are, then adjustments must be made. These adjustments are made in one of two other files to be discussed later: the Master/unit allocated file and the L-card/special projects file. A special note to you Navy engineer planners: have you accounted for ground based support for the fleet? This is especially true for operational fuel storage.

CARDS FILE

The next area to tackle is the cards file. The name is a carry-over from the time when the files were compiled on computer punch cards. It is important because it contains parameters that have a significant effect on the results. The file itself is divided into five subsections. They are referred to in the users' guides by the letters assigned to them: A, C, D, G, L, and P. The letters were used back in the computer dark-ages to allow the computer to distinguish changes in 80-column card formats when all input was done by submitting card decks to the main-frame operator. Unfortunately, the people who chose the letters did not select them so that they stood for anything! Therefore, you just have to memorize them so when you tell the computer-types that you want to make changes, they will understand what you are talking about. I'm going to go through each letter separately.

A-CARDS--BASE DEFINITION

"A" CARD - BASE DEFINITION

GEO-LOC CODE	BASE COMPLEX NUMBER	GEOLOCATION NAME	COUNTRY	BASE OWNER
ACRP	010	CALDIERA AMMO STORAGE	PO	F
RGJW	015	NAPLES PORT	IT	N
RGKE	015	NAPLES CITY	IT	N

The records in the A-cards section of the file contain all the geolocation codes (GEOLOCs) that are pertinent to your area of operations. These GEOLOCs coincide with those found on the time-phased force deployment list (TPFDL) and relate to points of debarkation (POD) and final destinations. GEOLOCs of bases in the area of operations where there are existing U.S. or allied-owned facilities are also included in the list. You then group the GEOLOCs into base complexes which are represented by three digit codes. These base complexes should be developed to best reflect the concept of operations and the way you want the results to be organized at the end. A base complex can consist of one or more GEOLOCs.

What does a base complex represent?

Base complexes can represent a geographic area, i.e., all GEOLOCs in a 50 mile radius or an operational area (i.e., the area within which an engineer unit would operate). Base complexes can also represent the separation by service within the same area, i.e., if both the Air Force and Navy were operating at GEOLOCs closely situated to each other (an airbase located at the other side of a port city). Creating separate base complexes in the same location ensures you that the correct service planning factors are applied.

Who is the base-owner and what does it mean to me?

The base-owner allows you to designate which service's by-base and total population planning factors will be used to generate additional facility requirements. You can either personally select the service, or allow the model to select it for you. The CESPG selects a base owner as the service that has the greatest total population at the base complex. This is determined by programs that extract and analyze data from the TPFDL.

How do I know if the base complexes are correctly designed?

Unfortunately the only way I've been able to do this is to get a map and start marking the GEOLOCs with base numbers and circles. This may not be efficient, but it is effective. It provides you a good view of how the GEOLOCs have been grouped and shows whether it matches the current operations plan (OPLAN) and your analysis. There are several things that can assist you in this process: first is a pre-processing program that matches the GEOLOCs on the TPFDL with those in the current CESPG to let you know which ones are not accounted for in the model. There is also a series of TPFDL analysis reports that can tell you the distribution of forces by GEOLOC, and base populations by service over time. If you want these reports, tell your CESPG operator that you want the DECK-7 and DECK-10 reports. Better yet, look at page 2-14 "Analysis Module Output Listings" in the CESPG User's Manual and pick out the specific reports that you think you need. This will cut down on the paper output.

Tidbits.

The DECK-7 "Troop File Extraction and Error Reports," and the DECK-10 "Troop File Analysis Reports" have been found to be invaluable during the course of our analyses. There is a ton of useful data and TPFDL sorts in there to make even the most die-hard analyst happy. The nice part is that the reports are self explanatory and easy to follow (unusual for a CESPG product!) and extremely useful time and again (most unusual for CESPG products!!) The list of the reports and the analysis program number are shown in **Figure A-2.**

Analysis Modules	Analysis Program Number	Contents of the Report
DECK-7	A05	Listing of TPFDL by Force Requirement Number (FRN)
	A05	TPFDL Error Report
	A06	Unit Type Codes (UTC) on TPFDL but not in CESPG files
	A10	List of UTCs that arrive as split shipments
	A12	List of UTCs with final destination GEOLOC and grid coordinates
	A12	List of GEOLOCs on TPFDL, but not in CESPG A-cards
DECK-10	A15	List of GEOLOCs, by country with grid coordinates
	A20	List of troop strength by GEOLOC grouped by the first digit of the UTC
	A25	List of troop strength by GEOLOC code divided by service
	A30	List of engineer units contained in the CESPG engineer capability file, but not listed on the TPFDL
	A30	List of engineer units and their capability contained in the TPFDL and the CESPG engineer capability file
	A35	Graphs showing troop strength by actual arrival date for each base complex number and cumulative troop strength over time by base complex number
	A36	Listing of base complex numbers showing base owner, populations by service, and populations classified as combat versus non-combat
	A40	List of engineer units on TPFDL
	A45	TPFDL listing sorted by final destination GEOLOC and Required Delivery Date (RDD) date
	A45	Summary of troop strengths by service and RDD date for each final destination GEOLOC
	A50	Listing of TPFDL sorted by FRN
	A55	Listing of TPFDL sorted by Point of Embarkation (POE) GEOLOC
	A60	Listing of TPFDL sorted by UTC
	A75	Listing of UTCs on the TPFDL but not in the CESPG Master File list
	A80	Listing of troop strength by UTC for each base complex number
	A85	Listing of UTCs by base complex number ordered by RDD date

Figure A-2. DECK-7 AND DECK-10 TPFDL ANALYSIS REPORTS

"C" CARD - BASE SUPPLY STRUCTURE

ECH 1 (BASE CMPLX)	BASE SUPPLY/ SUPPORT STRUCTURE ONE E2 E3 E4 E5	BASE SUPPLY/ SUPPORT STRUCTURE TWO E2 E3 E4 E5	BASE SUPPLY/ SUPPORT STRUCTURE THREE E2 E3 E4 E5	BASE SUPPLY/ SUPPORT STRUCTURE FOUR E2 E3 E4 E5	BASE SUPPLY/ SUPPORT STRUCTURE FIVE E2 E3 E4 E5
010	070 078 031 000	000 078 031 000	000 000 000 000	060 078 040 000	000 000 000 000
070	070 078 031 000	000 000 031 000	000 000 000 000	000 000 000 000	000 000 000 000
031	000 000 031 000	000 000 031 000	000 000 000 000	000 000 000 000	000 000 000 000

The C-card records allow you to specify logistics resupply structures in the area of operations. For each base complex that you defined in the A-cards, you can create a logistics tail. This structure tells the model where units stationed at a base complex would go for higher echelons of supply. For the Army this equates to where division/ASG, corps/CSG, and EAC/TAACOM supply depots are found. If you have not defined planning factors for any echelons higher than the unit level, there would be no need to have any base complex numbers in the support structure columns.

What do the Ech 1 (base cmplx), E2, E3, E4, and E5 columns refer to?

These columns stand for echelons 1, 2, 3, 4, and 5. They are matched to the planning echelon numbers discussed in the Planning Factors file section above. If you have planning factors only in column Ech 1 in the planning factors file, then you would have no need to define any supply structure. Facilities would be generated strictly at each base complex as units arrive. If you have planning factors in any of the other columns (echelons 2-5), then you should have a corresponding base complex structure in the C-cards that defines where these higher echelon facilities would be located in the AOR.

Recall from the planning factors file that echelon 2 (E2) is the division level supply point for the Army, or the ALSS for the Navy/Marine Corps. Echelon 3 (E3) is the Army corps supply point, echelon 4 (E4) is the theater level/TAACOM supply depot, and echelon 5 (E5) is anything above that level.

Next to each base complex number the planner has the ability to define the logistics supply locations by their base complex number. This allows the model to construct facilities at these higher echelon locations for each person/unit that is stationed at the echelon 1 base complex. For example, if the echelon 1 base complex was a forward location, say somewhere along the 38th parallel in Korea, where would that unit go for its supply from the division? Where would that division level depot get its resupply from Corps, and where would the Corps depot get its resupply from Army or theater? **NOTE:** Any base complex numbers you use must be defined in the A-cards/Base Definition section of the Cards File.

Why are there five base supply structures?

These five supply structures follow the same principle explained previously. They are there to permit you, as the planner, to account for varying depot structures for different types of supply. For example, the Army may have one set of locations for general supply depots, another set of locations for fuel depots, and yet another set of locations for medical supplies. The official documentation states that supply structure 1 is to reflect ammunition resupply, structure 2 is for POL, structure 3 is for general supplies, structure 4 is for medical supplies, and structure 5 is for anything else you can think of! The graphic in **Figure A-3** shows how this works.

If you wish to use these different supply structures, then you must ensure that the facilities are referenced in the planning factors file under the column "Supply Structure Index." For example, if you want all your ammunition storage to be reflected by the base supply structure you created under structure 1, then a "1" must be placed in this column in the planning factors file. Should you develop a different base supply structure under structure 2 for your POL commodities (diesel, MOGAS and JP, then you would have to place a "2" in the planning factors file supply structure index column.

Tidbits.

If all classes of supplies are located in the same depots, you need only use base supply structure 1, but ensure that your planning factors reference supply structure index 1.

If units stationed at a base complex get all their echelons of supply from the same location, then the same base complex number would be listed in each echelon column (E2, E3, E4, and E5).

If you do not use all five echelons or all five base supply structures, make sure all the base numbers in the unused categories are all 000. This will ensure no unwanted facilities are constructed.

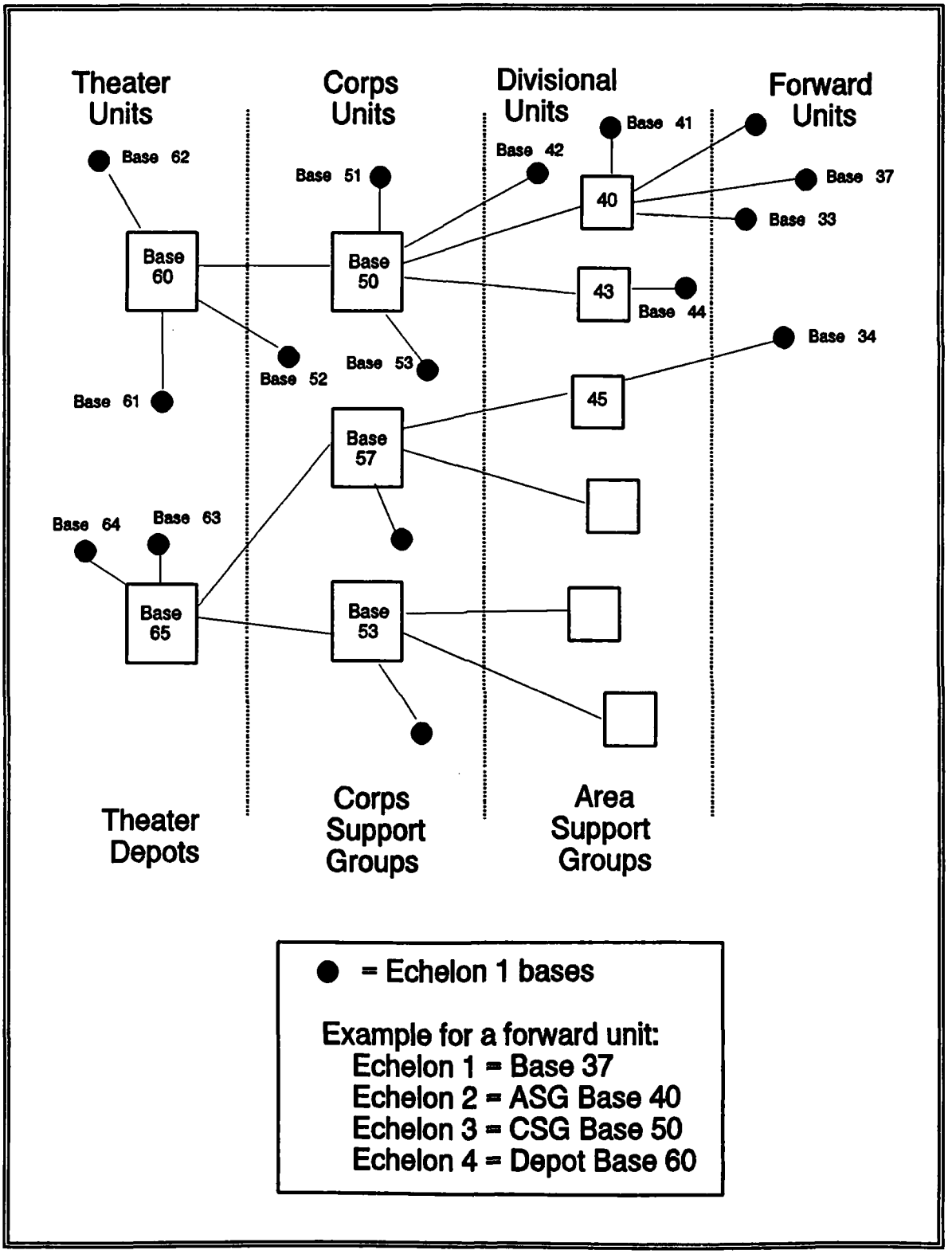

Figure A-3. CONCEPT OF LOGISTICS SUPPLY STRUCTURE FOR C-CARDS

"D" CARD - BASE CONSTRUCTION POLICY

		BASE COMPLEX NUMBER				
		0	0	0	0	
JCS	U.A.	1	1	5	7	
CATCODE	POLICY	0	3	0	6	....
113A	2	3	2	2	4	....
116A	2	2	1	1	1	....
116B	1	3	1	2	1	....

If you aren't confused by now, just wait until you see the D-cards. This section of the Cards File is designed to allow the planner to adjust construction of facilities generated by planning factors at each base complex. It is a huge matrix that you fill in for each JCS CATCODE listed for each base complex number. It allows you to tell the CESPG to either build that type of facility for every person/base/aircraft that arrives at that base; or for only people/base/aircraft designated as non-combat. It will also allow you to tell the CESPG that you don't want to build it at all because of CINC guidance, service policies, or assumed availability from the host nation. As the planner, it will allow you to turn off construction of facilities that are tied to a unit's UTC (this facility information resides in the Master File). The "U.A. Policy" (short for unit allocated) column is where you exercise this capability.

What are the construction policies?

The D-card matrix allows you to tell the model what facilities you want to build at a specific base location. This process is referred to as "setting the construction policies at base complexes." There are four policies currently available to the planner. All of them are represented in the model by numbers.

Construction Policy 1: A construction policy of "1" means that you **will not** build that JCS CATCODE facility for any people/units/aircraft that arrive at that base complex, regardless of whether it is their final destination or just their POE.

Construction Policy 2: Policy code "2" tells the model to build that facility for only the non-combat oriented people/units/aircraft (the delineation of combat and non-combat is attached to each UTC found in the Master File).

Construction Policy 3: Construction policy "3" tells the model to construct a given facility for everyone at that base location, even if it is just their POE and their final destination is another base complex number.

Construction Policy 4: Policy code "4" simply tells the model that you want to apply war damage values to a existing facility, even if you don't need to construct it.

How do I use the D-cards?

The D-cards are to be used to reflect CINC or service policies. Several examples should help clarify how to use the codes.

- POL storage already exists at a naval base. The CINC has stated no additional storage will be constructed here, regardless of what the planning factors may calculate. The policy would be reflected by entering a "1--do not build for anyone" for that JCS CATCODE at that base complex number.

- However, this existing storage is also a prime target for the threat and you want to ensure that damage factors are applied to the facility. In that case, you would change the policy code to "4--do not build, but war damage." (War damage factors are found in the Asset Files and are applied only to existing facilities owned by either the U.S. or U.S. allies).

- Air Force by-base planning factors allow for construction of arm/disarm pads at every air base. The Air Force planner knows that there are no fighter aircraft going into a given base complex. The only units going to that location are communication and radar. Therefore, the planner would place a "1--do not build" in the appropriate column.

- On the other hand, regardless of an aircraft's mission, be it combat fighters or incoming cargo aircraft, they will require parking apron. The planner would place a "3--build for all" code in the column for parking apron at a base complex number where both types of aircraft are expected to operate.

- Often the TPFDL does not accurately reflect forward stationing of units past the initial POE into the area of operations. Billeting of Army units at the POE is to be limited to only those non-combat units that are "permanently" stationed there. All combat units are expected to move to another location further forward, and will not require billeting. Therefore you would put a "2--build for non-combat only" in the columns associated with billeting facilities.

You can also use the D-cards to turn-off planning factor generated facilities when you need to "hand-jam" a project using the L-cards (discussed shortly). For example, suppose that you have reviewed some planning documents and found that the Facilities Mobilization Plan (FMP) for a Naval Air Station lists a requirement for 10,000 square yards of extra parking apron. If you look at the planning factors, they will only generate a requirement for 5,000 square yards. To make sure the FMP identified project overrides the planning factors at that location, you would need to put a "1" in the row for 113A-Parking Apron, and then generate the FMP parking apron requirement using L-cards.

G-CARDS--JCS CATEGORY DESCRIPTIONS AND PRIORITIES

"G" CARD - JCS CATEGORY DESCRIPTIONS

JCS CAT CODE	CATEGORY DESCRIPTION	UNIT OF MEASURE	JCS PRIOR	EARLIEST START DATE	DEFER COMPLETION DAYS	PRIORITY NUMBER
111RW	RUNWAY FIXED WING	EA	0			001
112AW	TAXIWAY FIXED WING	EA	0			002
113AW	A/C PARKING APRON	SY	0			003
:						:
:						:
214AB	TANK/AUTOVEH SHOP	SF	0	010		087
:						:
:						:
722AC	DINING FACILITY	SF	0		100	400

The G-cards act as the "Master" list of all JCS CATCODES that will conceivably be used for your model run. These CATCODES are listed in joint service/CINC priority order. The CATCODES are given as five-digit codes. The last letter in the series distinguishes whether the CATCODE is for initial standard beddown (B), temporary or permanent construction (C), emergency war damage repair (W), or complete restoration of damage to original construction standards (R).

Two important notes about this section of the Cards File:

First, if a CATCODE is not found in the G-cards, the model will not recognize it anywhere else. Let's say you want to account for open ammunition storage requirements and you have a planning factor in the Planning Factors File that will generate squares yards of storage space for each person that enters the AOR. You have a facility component in the Components File that tells you the cost and manhours associated with constructing open storage. However, if you look at the G-cards, you find that the CATCODE for open storage (425AB) is not listed. Because the G-cards act as a "Master " listing of all the types of construction you wish to do in your AOR, the model will not calculate the requirement for open ammunition storage.

Second, you have the ability to add not only accepted JCS CATCODES to the listing, but also the freedom to add unique CATCODES that account for OPLAN requirements. For example, if you know that you will have to develop a logistics-over-the-shore (LOTS) site in support of Army or Marine Corps forces--there is no JCS CATCODE for LOTS operations. You can make up your own code to account for it. The only restrictions are that it must be 5 characters long, end in a B or C, and not duplicate another code already in the G-cards. When you determine the manhours and costs associated with development of the site and add them to the components file, you must ensure that you use the same CATCODE that you added to the G-cards.

How do I determine the Priority of CATCODES?

The priority of each CATCODE is based on guidance provided by the CINC in the OPLAN. They must be developed from a joint operations perspective. Each theater has its own definition of ranking. In Europe, the U.S. European Command guidance describes engineering support by one of three definitions: priority 1, 2, or 3. In United States Central Command (USCENTCOM) they use the terminology vital, critical, and essential. CINC guidance may state that the top priority is to keep the airfields operational, second is to keep the ports open, and third to develop the logistics base. If the Air Force policy is to operate out of existing airfields, all CATCODES dealing with airfield damage repair to critical operational facilities and development of ADA positions would come first in the G-cards. CATCODES dealing with port operations which could include war damage repair would come second. The third set would include CATCODES that deal with logistics support to include development of depot facilities, main supply route (MSR) repair, and pipeline construction.

To deal with the problem of having to prioritize over 400 CATCODES, ESC uses the approach of grouping tasks that have similar importance. Then we look at the CATCODES associated with those tasks. The table in **Figure A-4** illustrates how we do this.

PRIORITY	INCREMENT NUMBER	INDIVIDUAL TASKS BY CATCODE
1	1 - Repair of critical air-field facilities	111RW - Emergency repair of runways 112RW - Emergency repair of taxiways 113RW - Emergency repair of aprons 149BW - Emergency repair of arresting barriers
	2 - Construction of critical facilities	111AB - Runways 112AB - Taxiways 149AB - Aircraft revetments (initial standards)
2	3 - Emergency troop billeting	725AB - Troop housing 725BB - Troop messing
	4 - Repair of operational facilities	133AW - Control tower 116AW - Aircraft wash rack 141DW - Hardened aircraft shelters
3 : :	: : :	: : :

Figure A-4. SAMPLE APPROACH TO DEVELOPING ENGINEER TASK PRIORITIES

Why does each CATCODE have a unique priority number?

The CESPG model was originally designed to not only calculate engineer requirements, but also compare available engineer capability against the requirements and determine how many of the requirements could be accomplished. The model "scheduled" available capability against the requirements based on the priority of each requirement. Therefore, if capability was available, it would be applied to the highest priority task at a specific base complex. The basic logic sounds reasonable, but over the years the accuracy and reliability of this portion of the CESPG has come into **serious** doubt. Users have complained that it never fully applies the available capability, and underestimates tasks accomplished. As a result your recommendations can overestimate the additional capability needed in your region. I suggest you use any results from what is known as the "Schedular" with **extreme** caution.

What are the earliest start date and defer completion days columns for?

These allow you another means of flexibility in generating requirements. Using the earliest start date, you can delay construction of any JCS CATCODE until a specified date after C-day. Say guidance has been given that U.S. forces will not need to perform base maintenance functions for the first 20 days of mobilization. You can enter "20" in this column, and all manhours associated with that requirement would not appear until C+20. If you wish to delay construction of facilities tied to a unit's arrival at a base location, rather then the start of the conflict, you would add the delay days to the defer completion days column.

What is the JCS Prior column for?

To be honest, I have no idea. I have never found any documentation on this and no one I have talked to has been able to explain it to me.

Tidbits.

It's important to make sure the unit of measure (UOM) that you list in the G-cards is the same UOM you use in the planning factors file and the components file. The model does not check for differences. This may not sound traumatic, but if your planning factor generates requirements in square yards and your component is in square feet, you will be building considerably less then the actual requirement. Most often this occurs in construction of fuel storage. Depot level storage is measured in barrels, operational or unit level storage is measured in gallons. The components are usually the same type of facility--bladders. However, construction for 10,000 gallons is considerably less than construction for 10,000 barrels (there are 42 gallons to a barrel). A couple of other common errors occur in referencing units of measure for rapid runway repair (RRR), the services inter-mix "eaches" of craters (i.e., the number of craters) with square yards of pavement, and also square feet for covered storage versus square yards of open storage.

L-CARDS--EXTERNALLY DERIVED CONSTRUCTION PROJECT REQUIREMENTS

"L" CARD - EXTERNALLY DERIVED CONSTRUCTION PROJECT REQUIREMENTS

BASE COMPLEX NUMBER	JCS CAT CODE	CATEGORY DESCRIPTION	CATEGORY QUANTITY	COMPONENT CODE	COMPONENT DESCRIPTION	COMPONENT AMOUNT	DEMAND COMPLETION DATE	SER-VICE	ALTERNATE PROJECT TYPE	ALTERNATE CONSTRUCTING AGENCY
034	111A	RUNWAY FIXED WING	277576			00000000	000	F		
034	411E	JP STORAGE	12600			00000000	000	F		
050	125A	POL PIPELINE	0	12510L	BOUYANT POL HOSELIN	00000001	020	N		
050	125A	POL PIPELINE	0	12510L	BOUYANT POL HOSELIN	00000002	029	N		

The L-cards are commonly known as the "Special Projects File." This portion of the Cards File exists to account for any construction projects that cannot be generated through planning factors or the Master File (to be discussed next). Things that fall into this category include pipeline construction, MSR maintenance, fleet fuel storage, and base operations and maintenance. The requirements are tied to a unique base location and have a planner specified completion date (i.e., when the facility needs to be operational or when the task needs to be performed). The planner can specify the facility to be used, and what service needs the support.

Why is the JCS CATCODE only four digits when everywhere else in the model it's five digits?

This is a good question, and has another one of those "who knows" answers. Actually there is a good explanation, but it is a bit confusing. The CATCODES are four digits to allow these special requirements to be compared with available assets listed in their respective files. Since assets are not cataloged as being initial (B for beddown) or temporary (C) standard, they don't carry the fifth digit that you find in the components file. This allows the model to look at the special project and see if there is something that already exists that can fill the requirement. If there isn't, then the facility/task would be performed.

How come some entries have a category quantity and others only a component amount?

This has to do with how the model does, or does not, calculate war damage. For an existing facility to sustain war damage, 100 percent of the facility must be required. The logic that comes into play here is that if you only require 40 percent of a facility, and 20 percent of it sustains damage, then the remaining 60 percent of the structure would be able to accommodate the original 40 percent requirement. Therefore, no requirement for engineers to repair war damage would occur. If you want damage factors to be generated regardless, you have to tell the model that you need 100 percent of the facility at C+0. This is most often done for facilities such as runways, taxiways, ports, POL depots, etc. These are facilities that may not be generated by planning factors, but are still needed to support the deploying force. **NOTE:** This is the only purpose for the category quantity column. If you want to use the L-cards to generate "new" construction projects, then you only use the component amount column.

Why specify a component code?

Since the projects listed in the L-cards are there to account for engineer manhours, you need to tell the model what facility component in the component file it should use. If you do not put a component code here that matches one in the component file, the model will not "build" your project. Another obscure fact here is that any component code that you put here must be married to a "B" suffix JCS CATCODE in the component file. The CESPG will not recognize component codes that are associated with "C," "W," or "R" CATCODES. In the graphic on page A-20, the component code 12510L for Buoyant POL Hoseline must have a JCS CATCODE in the components file that is 125AB.

What is the component amount?

If you are entering special projects/tasks (not to generate war damage) through the L-card method, you have the option of specifying the facility component code that you want the model to select from the component file. You must tell the CESPG how many of those components you want it to use. **Do not** put in the size of the facility needed, but the number of facility components it would take to construct the size needed. For example, if you wanted to build a 5,000 square foot building, and the facility component that represented how you wanted it constructed was for a 1,000 square foot increment, then you would tell the CESPG that you needed 5 of those components. **NOTE:** If the facility component code you specify is associated with a "B-beddown," "C-new construction," "W-emergency war damage repair," and "R-restoration" JCS CATCODE, then the model will always select the facility component with the "B" JCS CATCODE.

What are the Alternate Project Type and Constructing Agency columns for?

These columns were originally designed to allow the planner to generate follow-on construction projects for one service by another service. Specifically it was to permit the Air Force to generate follow-on repair work for the Army. I personally have never seen anyone use it. There are alternate ways of doing this within the model, by using the "follow-on" columns in the components file.

Tidbits.

You may be wondering where contents of the category and component description columns come from, since you don't have to enter them as part of the input file data. The CESPG puts the same text in here that exists in the G-cards for that JCS CATCODE category description, and the components file for the description listed for that component code.

The L-cards only select beddown CATCODES. If you want another standard of construction besides beddown (lets say wood-frame buildings rather then tents) you must "fudge" it by creating a unique JCS CATCODE with a "B" suffix for the facility component code you want to use in the components file. If you do this, you must remember to add that unique code to the G-cards. You can use any series of three numbers and a letter that does not duplicate an existing CATCODE. For example, I usually make my unique codes something like 999A, so it is very clear that it stands for something special.

Let's say you have existing assets at a base complex and you want to build additional requirements through use of L-cards. You know the existing assets will be used against other requirements (either those generated by planning factors or master file projects) so you have to make the component amount large enough to account for the existing asset--plus the "new" requirement. We ran into this problem with some Navy analysis we were trying to perform. The fleet fuel storage requirements were identified over-and-above any that would be generated by planning factors and the existing assets were only to be used for the ground based requirement. To make sure the added fuel storage was generated, we added the existing storage to the fleet fuel requirement. Otherwise, the existing assets would have canceled out a portion of the fleet storage requirement.

P-CARDS--HOST NATION CONSTRUCTION RESPONSIBILITY

"P" CARD - HOST NATION CONSTRUCTION RESPONSIBILITY

BASE NUMBER	CATEGORY CODE	CATCODE DESCRIPTION	CONST AGENCY	1ST DAY AVAIL	LAST DAY AVAIL	MAX QTY PER DAY	MAXIMUM MH/DAY
001	411CB	DIESEL STORAGE	H	024	090		1000
001	125AB	POL PIPELINE	H	010	030	00000001	
055	111RW	RRR RUNWAY REPAIR	H	000	050		400

The P-cards are designed to allow you to account for host nation or contract labor support. This support may be tagged to a specific base location and JCS CATCODE. If you don't put in these factors, the CESPG will apply the manhours on a first-come-first-serve basis for any requirement at any location. I've used this file to account for host nation support identified for installing pipelines in Southwest Asia. The host nation had agreed to so many manhours of support. When we ran the CESPG we found out that the support agreed to did not meet the manhours generated by the requirement. This meant that either the agreement needed to be re-evaluated, or more Army engineers would be required.

Do I need to specify a base number?

The CESPG structure allows you to tag host nation/contract support to a given base complex if that's how the agreement reads. If you don't put a value in this column, the CESPG will apply the support defined in the remaining columns throughout the theater of operations. Take heed, I have not tried this. In theory the manuals say you can do this, but when you look at the up-date record formats, the base number is said to be required, i.e., there must be a value in it. This same disconnect is listed for the JCS CATCODE data discussed next. You will have to try this out on your own!

Do I have to identify a category code?

You only have to put a JCS CATCODE in this column if the agreement specifies the type of support that will be given. For example, it may be that the host nation will provide support to develop initial standard diesel fuel storage sites. Therefore you would put "411CB" in this column. You must make sure the category code you select is in the G-cards, and has a facility component associated with it in the components file. If you leave this column blank, the CESPG will apply the support specified in the remaining columns to all projects. If you want the host nation/contract support to apply to either the development of those storage sites or the repair of damage sites, then you would leave off the last digit and only put in "411C." Again, the up-date program descriptions claim that this field must contain all five digits. I've no direct experience with this, so you'll have to let me know what really happens if you leave this blank!!

What are the days available for?

Often host nation agreements or contracts stipulate the period of time for which they remain in force. For example, the host nation would be able to provide support for war damage repair to an airfield from D-day through D+20. The model accommodates these situations by permitting you to specify the first and last day support is to be available. (Remember that all the days in the CESPG refer to C-days, not D-days!). If you don't put anything in these columns, the CESPG assumes the support continues for the entire scenario.

What's the difference between the "max qty per day" and "maximum mh/day"?

The CESPG lets you specify either the quantity of the requirement that can be accomplished per day, or the number of manhours that will be supplied. You cannot put a value in both columns. For example, the agreement may read that the host nation will be capable of repairing three runway craters per day. In that case you would put 3 in the "max qty per day" column (that is if the facility components and JCS CATCODE used are measured in "eaches," if not you may need to change to square yards). If the agreement states that they will provide 300 manhours of labor per day to repair craters, then "300" would be entered in the "maximum mh/day" column.

Tidbits.

Take note that when you specify host nation/contract manhours, the model considers them equal to U.S. troop manhours given in the components file. In other words, one military manhour equals one civilian manhour.

If you enter more than one P-card for the same JCS CATCODE at the same base location, the model will only recognize the first P-card. There are two ways to get around this. Either combine the support into one, or develop a unique JCS CATCODE to be able to distinguish between the two. This is by far the most drastic approach, and requires you to add that new CATCODE to the G-cards and to make sure it and a facility component code are in the component file. (See my discussion under the L-cards Tidbits for developing your own CATCODES).

UNIT MASTER FILE
(E AND F CARDS)

			E CARD DATA							F CARD DATA					
UTC	SVC	UNIT NAME	MSN	TROOP STRNG	TOTAL EQUIP ACFT	TOTAL EQUIP VEHIC	ACFT TYPE	VEHIC TYPE	JCS FACILITY CATEGORY	JCS FACILITY CATEGORY DESCRIPTION	QUANTITY FACILITY CATEGORY	UNIT OF MEAS	FACILITY COMP CODE	FACILITY EQUIVALENT AMOUNT
3PPNN	A	ATK HEL BN, ABN	C	265	----	----	---	---	111C	HELIPORT CONST	1	EA	AG4131	1
									124A	ACRFT OP FUEL STOR	50000	GA	12400YA	1
3FQK6	F	TFE 08 F 15E	-	200	8	0	F15	---	---	----------	-------	--	------	------
FHGBA	A	GENERAL HOSP	-	583	0	20	---	---	510A	IN-PATIENT FACILITY	1000	BD	GH1011	1

The purpose of the Master File is to generate mission-oriented facilities for a unit. For every unit (listed by unit type code (UTC)) on the TPFDL, you can tell the model to construct a specific set of facilities. The facilities listed in this file are those required by the unit to perform its operational function. None of the facilities found in this file should duplicate those generated by **people**-generated planning factors.

There are two ways that requirements are directly generated by the master file. They are referred to as E-card and F-card data. E-card data requirements are based on the numbers and types of aircraft and equipment found in a unit. The F-cards generate requirements by specifically naming facilities. An example of F-card use would be a hospital unit which may require a helicopter pad, environmentally controlled storage facilities, concrete pads for operating rooms, and special electrical power support.

Why are there more unit type codes (UTC) then I have on the TPFDL?

The Master file is developed from the JCS Type Unit (TUCHA) data file, and therefore contains every active UTC in that file. It is your job as the planner to determine which UTCs are actually used by your TPFDL. There are various CESPG programs available (known as troop file analysis programs) that can help you identify these UTCs. More importantly, these programs will also let you know what UTCs are on the TPFDL, but **not** in the Master file. It is critical that these UTCs be added to your Master file. If they are not added, the model will not generate any requirements for them.

What does the "mission code" mean?

You have the ability to change how the model will view each unit: as combat (C) or non-combat (blank). The model uses this information when it generates requirements associated with the category codes listed in the D-cards for the unit. The D-cards determine the construction policies for facilities at each base complex. If a unit is classified as a combat unit and its final destination is base complex number 12, the model will look to see if the construction policy for each category code at base 12 is "3--build for all units." If the code is not a "3," and the unit is classified as "combat," the model will not generate a requirement for that facility at base 12. My reviews of this file for various theaters has found it outdated. I suggest you look over

this particular code. It can have significant impact on the final results of your analysis. For example, you could be building troop support facilities for entire combat battalions simply because they are mis-classified in the Master File.

Where do the troop strength numbers come from?

These values are derived from the information extracted by the CESPG from the JCS-owned TUCHA file. You can change these values to better reflect unit sizes in your AOR. However, the model **does not** use these troop strength figures to calculate anything. The requirements generated by people and total population planning factors found in the planning factors file use troop strength figures that appear on the TPFDL.

What are the Equipment and Type columns for (referred to as E-card input)?

Unlike the troop strength numbers, these values **must** be input by service planners. The model uses this information to generate requirements based on "equipment" related planning factors found in the planning factors file. You can input both the number of aircraft found in a unit and the number of other pieces of major equipment. At this point in time, the only "equipment" planning factors that exist are for aircraft (both fixed-wing and rotary). The way the model knows which planning factors to use is specified in the "type" columns. These columns must match the same coding used in the planning factor file ("planning factor type" column). For example, if a UTC ABCZZ has 24-F16 aircraft, you would place 24 in the total aircraft column, and F16 in the aircraft type column. A recent review by the Navy found a considerable number of errors regarding the types and number of aircraft that exist in their units, so make sure you look closely. You could find yourself under- or over-estimating support for your units.

What are the remaining Facility columns for (known as F-card input)?

There are six remaining columns in the file that comprise the F-card input. By filling in this data you can specify facilities that must be constructed to support the operational functions of that UTC. For example, a maintenance unit may require a covered area and hardstand to perform vehicle maintenance. If you look at the planning factors file, you'll see that there are no factors that generate these types of requirements. You need to determine the size of the requirement and place it in the "Quantity" column. You can get these sizes from several sources: service manuals, TACAPS or ABFCS, or better yet, from the unit itself. (You can't do this alone. It's imperative to coordinate with the other branches you support). Once you determine the size, then you must go to the component file and select the element that best matches the type of construction desired and enter that facility component code. Note that the JCS facility category column and facility component code column must match the same combination of codes you have in the components file. The final column of the F-card input tells the CESPG how many components it has to construct. For example, if you want to construct 50,000 gallons of fuel storage, and you select a facility component that represents a 10,000 gallon system, you would place a "5" in this column. **NOTE:** If you chose to use this means of generating requirements, you must have information in each column. The CESPG will simply ignore any incomplete records.

Tidbits.

You must beware, the same set of facilities will be generated each time that UTC is called on the TPFDL. The D-card construction policy file (U.A. policy column) is used to turn off these requirements at a specific base complex. For example, if you have the same type of unit going to different locations, and want to construct a set of facilities at one location and not the other, you will indicate that in the D-cards.

Since the D-cards are used to turn off construction based on JCS CATCODES alone, using them as a means to turn off master file requirements can create another problem: all master file requirements, regardless of the UTC, that use the same JCS CATCODE and arrive at the same base complex, will not be constructed. For example, if you didn't want to construct the 400 bed hospital scheduled at a base (CATCODE 510A, but you knew you would have to construct the 1,000 bed hospital (also CATCODE 510A, you would have to find another way to generate the 1,000 bed requirement (probably through the L-cards special project file).

Another problem I have run into (on the DESERT SHIELD/STORM TPFDL) was that one UTC was used for groups of dissimilar units. For example, one UTC was used for MEDIVAC helicopter units, some medical teams, and a few helicopter maintenance units. The best correction is to change the TPFDL. If this is not an option (as it was in my case), you may have to add the UTC-related requirements you want to account for by entering them in the L-cards.

ASSET FILES--HOST NATION AND U.S. ASSETS

ASSETS FILE
(BY GEOLOC, BASE COMPLEX, CATCODE)

BASE COMPLEX NUMBER	GEOLOC	JCS CATEGORY CODE	QUANTITY	UNIT OF MEAS	H / H+13/ H+26/	H+1/ H+14/ H+27/	H+2/ H+15/ H+28/	H+3/ H+16/ H+29/	H+4/ H+17/ H+30/	H+5/ H+18/	H+6/ H+19/	H+7/ H+20/	H+8/ H+21/	H+9/ H+22/	H+10/ H+23/	H+11/ H+24/	H+12/ H+25/
096	DTLV	211A	00008723	SF	.024	.015	.003	.005	.038	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-								
096	DXPB	211A	00004560	SF	.010	.005	.001	.000	.009	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-								
040	EBRZ	812A	00000070	LF	-	-	-	-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-								

The asset files list, by base complex number and GEOLOC code, all the facilities that are available to offset requirements generated through the planning factors, L-cards, master file, and assessment of war damage. It also contains information that allows you to apply war damage factors against these existing facilities (I'll discuss this feature separately).

- The initial set of U.S.-owned facilities are generated through use of available real property index (RPI) files. There is a program (RPI-to-ASSET run deck) that converts RPI facility and GEOLOC codes to CESPG codes. It is important that you review this

conversion table periodically to insure the maximum use of U.S. facilities by the model. If you still find that facilities are not accounted for, you will have to go in and enter them yourself.

- Host nation assets that are known to be available by signed agreement, or that the planner has a high degree of confidence in our being able to use, comprise the information found in the host nation asset file. Each service planner is responsible for identifying and entering the data in this file. You need to coordinate with other planners in your theater to make sure you aren't counting the same facilities twice.

Both the U.S. and Host Nation asset files have the same structure. When you run the CESPG, you have the option to include all assets, U.S. only assets, or no assets. If you choose to use all assets, the CESPG creates a third asset file that adds the asset data found in each file.

Why are there different GEOLOCs for each base complex number?

The base complex numbers match those you identified in the A-card file. If you had more then one GEOLOC code associated with each base number, and there are assets available at these GEOLOCs, then the file will reflect this. For example, you will see GEOLOCs ABCD and EFGH at base number 99 have the same JCS category code with a different quantity at each GEOLOC. This is done to make it easier to track just where assets are located. However, when the CESPG is run, it adds these quantities together and uses a single quantity amount for that base complex number.

Why do I need to be concerned about the unit of measure?

The unit of measure needs to match that found in the G-card file for each of the JCS category codes. This can cause problems and either overestimate, or underestimate the actual assets. As I mentioned in the section describing the G-card file, the disconnects that occur most often are in referencing depot-level fuel storage and local operational fuel storage and RRR versus deliberate crater repair. For fuel storage, one is measured in barrels, the other in gallons. In the area of crater repair, RRR is measured in "eaches" based on the number of craters, while deliberate repair is measured in square yards.

ASSET FILES--WAR DAMAGE TO EXISTING ASSETS

The asset files also allow you to associate war damage factors with JCS category codes at a given base complex number and GEOLOC code. These factors are calculated as a percentage of the existing facility quantity. The factors can only be applied each day for a total of 30 combat days. You do have the flexibility to have this 30-day period start anytime. Most often the start date (referred to as H-day) is selected to coincide with D-day.

Recall from the discussion above, that when the CESPG is run, assets at different GEOLOCs within a single base complex number are added together. This is not true for the damage factors. The model goes through a weighting process to come up with a combined damage figure. For example, if 40 percent (.400) of a 1,000 square yard (SY) ammo storage area is damaged at GEOLOC ABCD, the damage result is 400 SY. Another 3,000 square yards at

GEOLOC EFGH receives 30 percent (.300) damage on the same day and the damage result is 900 SY). The model adds the damage results to get 1,300 SY (400+900) and divides that by the aggregated facility quantity (4,000 SY). The resulting weighted damage factor becomes .325 (1,300/4,000, not .700 (.400 + .300). This same process is applied when the U.S. asset and HN asset files are combined.

Where do the damage factors come from?

This is possibly the most often asked question, and to my knowledge really has no definitive answer. Most of this data has been there since time immemorial. I suggest that you update this information according to any recent data you can find regarding war damage in your theater. There is a sister program available called the Attack Assessment Program (AAP) that can provide damage assessment data for your use. Contact JDSSC at the Pentagon to find out more about it.

Tidbits.

The model calculates the damage to a facility daily, and compares the repair requirement to the existing facility minus any other requirement for that CATCODE at that base. If there is still enough of that facility remaining, the model **will not** generate a repair task. For example, if you have 10,000 square feet of communications facilities, and the damage factor for that day is 10 percent (or 1,000 square feet), but there is no other requirement stated, the remaining 9,000 square feet is considered available to be used against the damage requirement--and no repair task is generated. If you do not want this to happen, you must enter the facility requirement in the L-cards, stating that all 10,000 square feet is needed at day C+0.

As with everything else in the CESPG, fixing one problem only creates another. Once you tell the CESPG that the 10,000 square feet is needed at C+0, any other requirements generated through the planning factors, master file, or L-cards for a communications facility at that base will generate new construction requirements, and **not** use the existing facility as an off-set. In these cases where you still want to account for war damage, you may have to end up inputting those repair requirements through the L-cards. (Of course, you have another set of problems to contend with in doing that. Take a look at the Tidbits section for the L-cards!)

ECAPB FILE--ENGINEER CAPABILITY

ENGINEERING CAPABILITIES (ECAPB) FILE

UTC	SERVICE CODE	UNIT NAME	TOTAL PERSONNEL STRENGTH	HORIZONTAL CONSTR CAPABILITY	VERTICAL CONSTR CAPABILITY	OTHER CONSTR CAPABILITY	TOTAL CONSTR CAPABILITY	INDIGENOUS LABOR SUPERVISION CAPABILITY
4WFAA	A	ENGR CO, LIGHT	210	840	0	0	840	0
4X7ME	A	EN CBT BN HVY	850	1260	2011	600	3871	3750
4F8AA	F	RED HORSE SQDRN	405	1260	1490	200	2950	0
40204	N	WDR M CO	162	630	690	0	1320	0

The ECAPB file contains information on engineer unit capability that is used by the Schedular portion of the CESPG once the requirements have been generated. The information contained in this file relates to the number of manhours of capability available daily for each engineer UTC in horizontal skills, vertical skills, and "other" unskilled labor. This information is available from each service representative on the Pentagon-level staffs. You can also adjust this information to meet your particular AOR needs. You need to be aware that in the near future the Army is going to change these measures to one of horizontal equipment hours and will no longer be reporting capability (or requirements) in horizontal manhours. If any units under your purview are to also have access to host nation labor units (this mainly occurs in Europe) you can place their total manhour capability in the column "Indigenous Labor." I cannot find any documentation on just how the CESPG uses this extra piece of information, so you're on your own with this one!

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LAST PAGE OF ANNEX A

APPENDIX TO ANNEX A:

FLOW OF CESPG PROGRAMS AND DATA FILES

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APPENDIX TO ANNEX A

FLOW OF CESPG PROGRAMS AND DATA FILES

This appendix contains a series of four graphics that show the general flow of the various CESPG programs and the data files discussed in the annex. I've included this to help you understand when the model accesses the various files, what procedures are occurring along the way, and what output is being created.

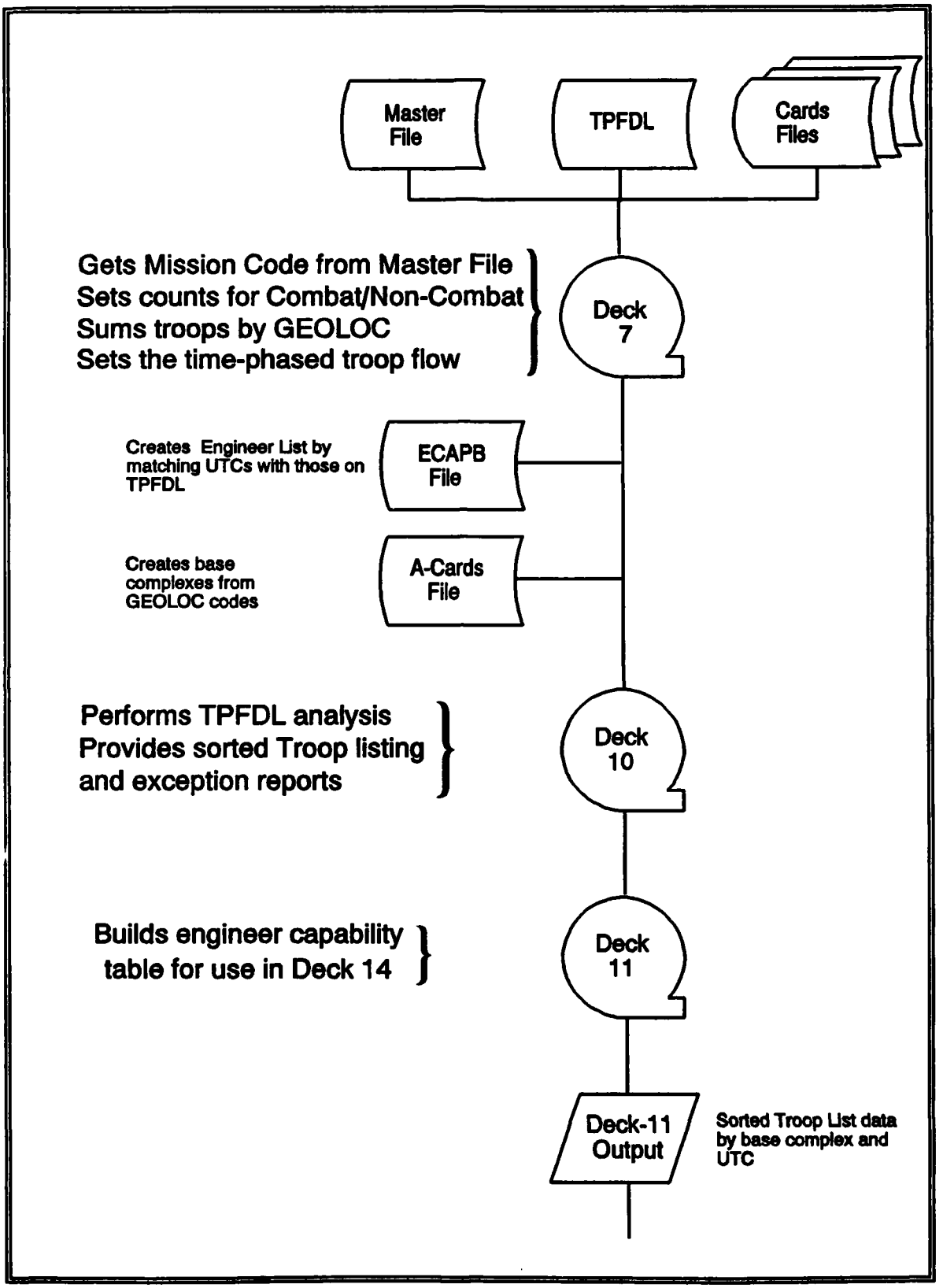

Figure A-1-1. FLOW OF CESPG PROGRAMS AND DATA FILES

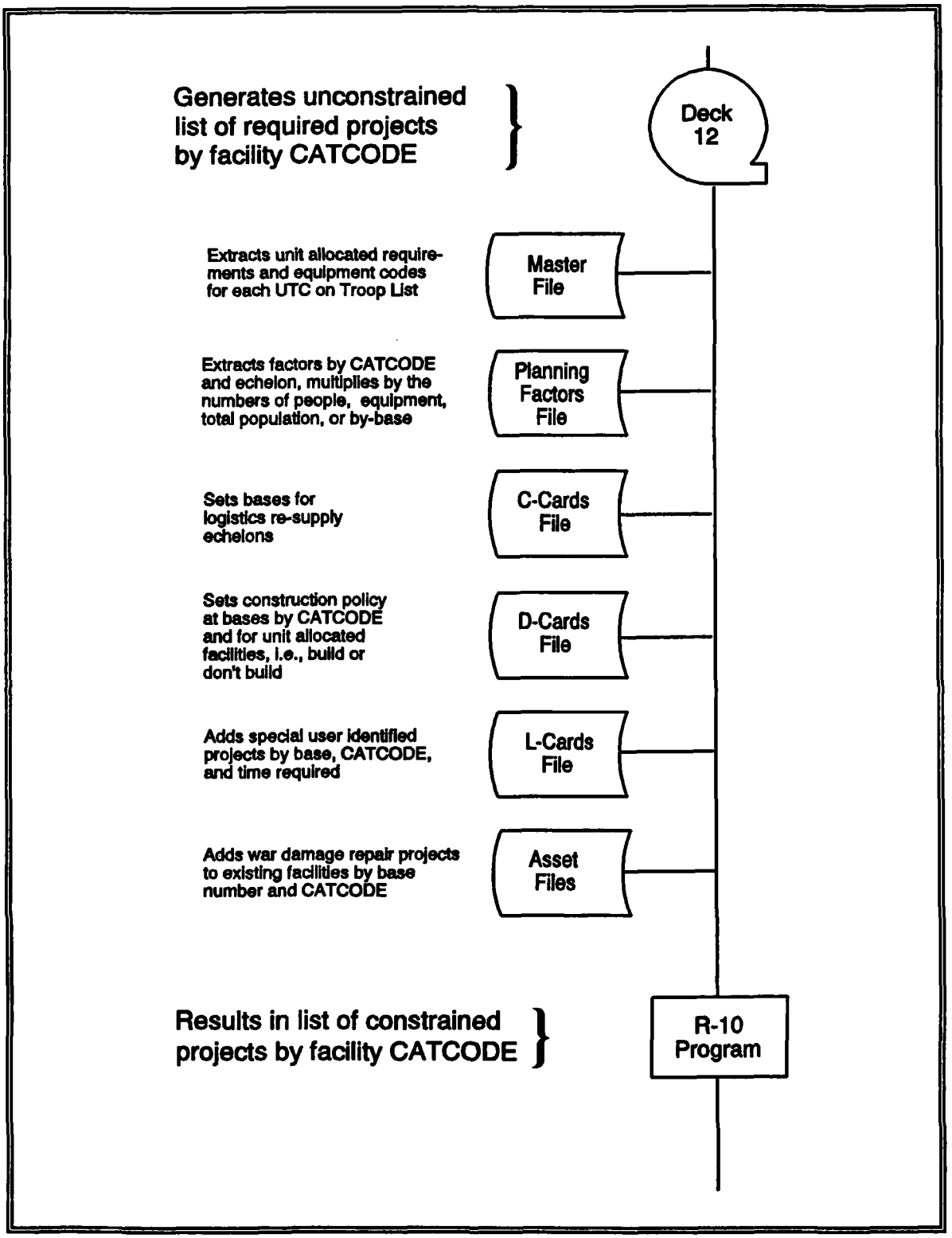

Figure A-1-1. FLOW OF CESPG PROGRAMS AND DATA FILES (continued)

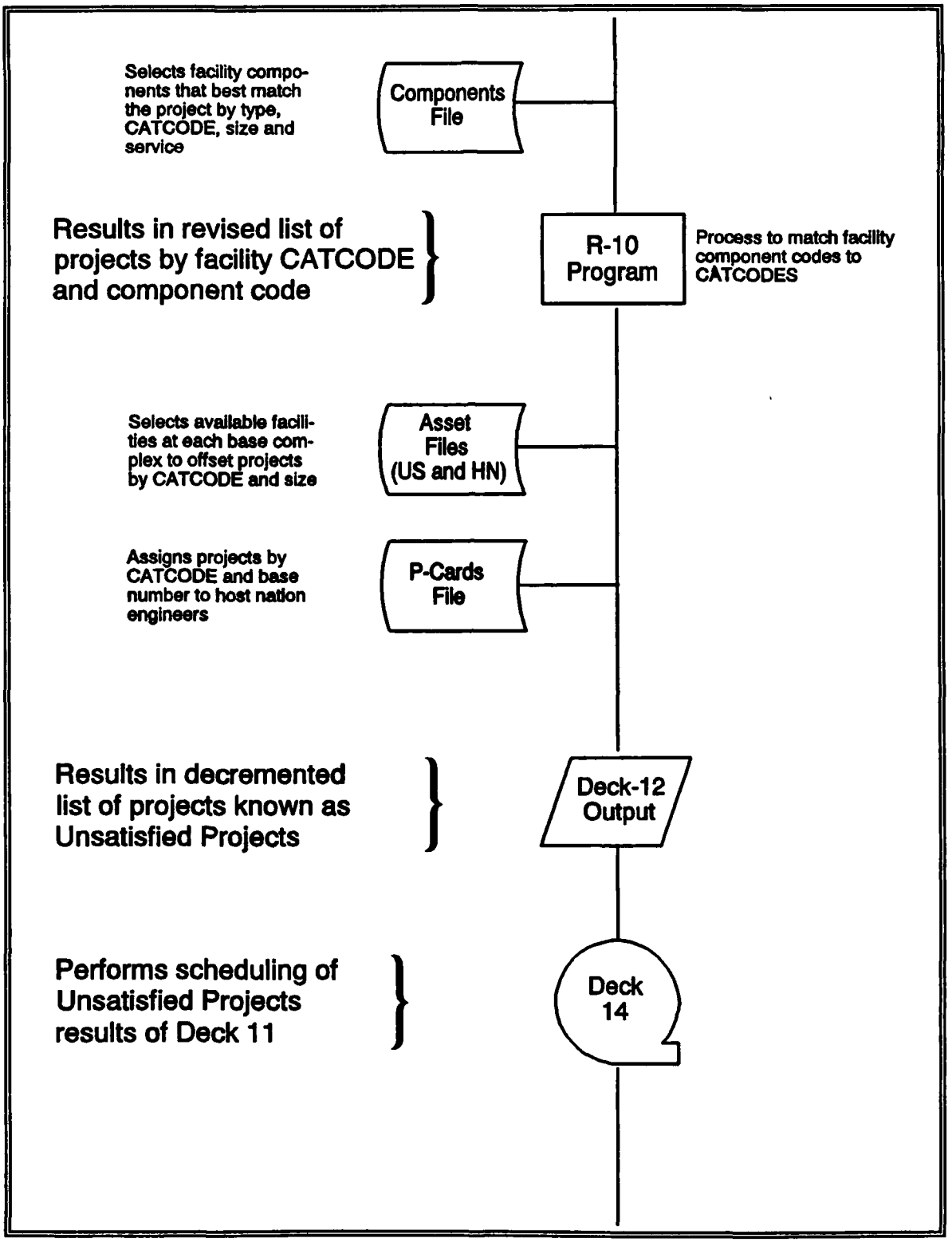

Figure A-1-1. FLOW OF CESPG PROGRAMS AND DATA FILES (continued)

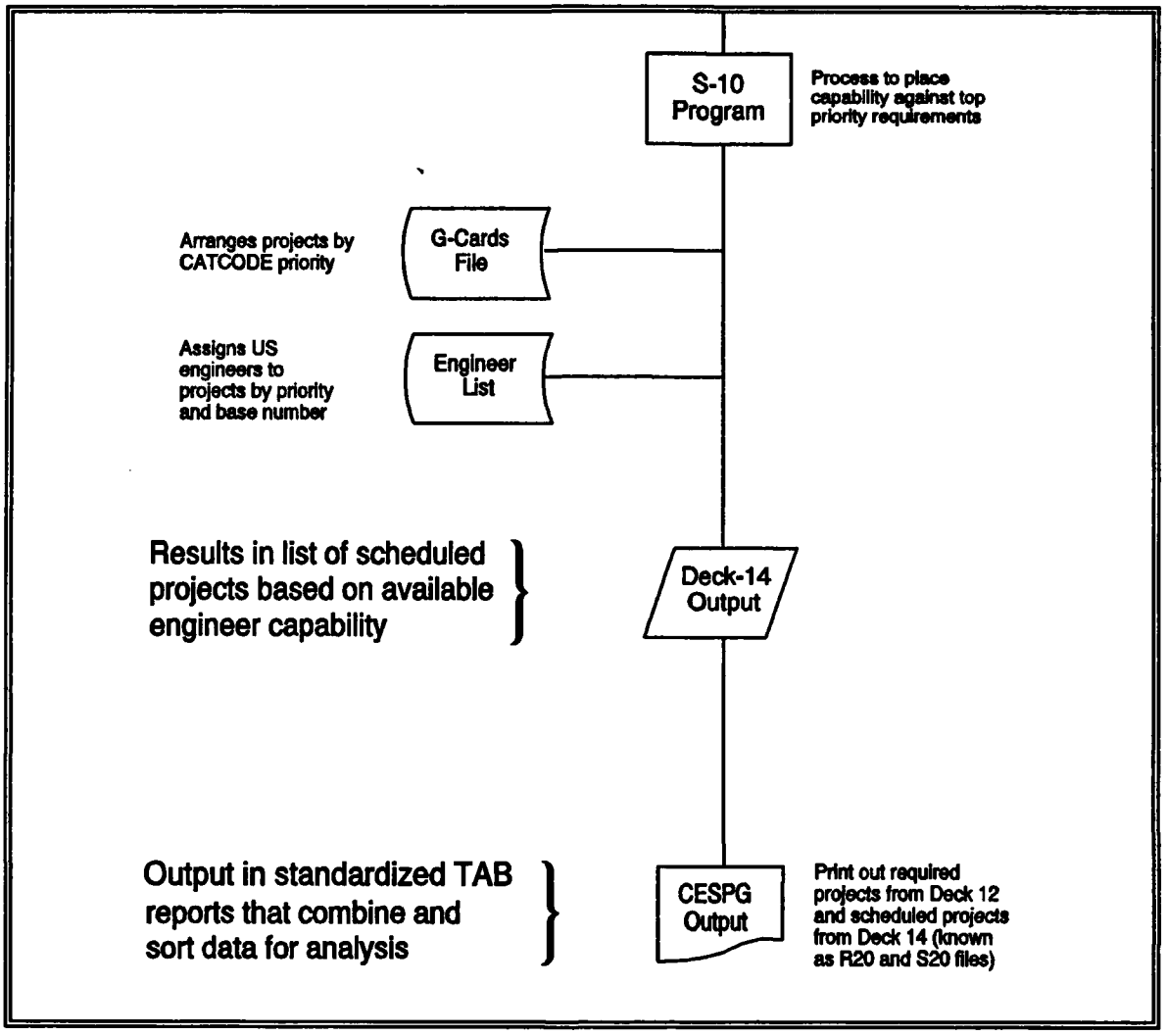

Figure A-1-1. FLOW OF CESPG PROGRAMS AND DATA FILES (concluded)

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LAST PAGE OF APPENDIX

ANNEX B

"EXAMPLE CESPG ANALYSIS" DATA TABLES

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ANNEX B

"EXAMPLE CESPG ANALYSIS" DATA TABLES

PURPOSE. This annex provides the data used to develop the graphics and tables for the main paper. I hope this also gives you some ideas on how to organize your CESPG results.

SCOPE. There are five tables that I used to support my example CESPG analysis. They include:

- The main parameters of the scenario setting out the regions, time periods, priorities and task increments (**Figure B-1**).
- The total manhours by priority, region, time period, and construction skill (**Figure B-2**).
- The manhours in the previous table further broken out by service (**Figure B-3**).
- The manhours by priority, region, time period, and task increment (**Figure B-4**).
- The time-phased capability by region, service, and construction skill (**Figure B-5**).

SCENARIO PARAMETERS.

REG	BASES	TIME PER	PRTY	INCREMENT	CATCODES
1	1, 10, 12 & 15	C+0 - C+9	1	1 - Airfield damage repair	111RW, 112RW, 113AW
2	30, 35 & 42	C+10 - C+19		2 - Repair of fuel storage and main supply routes	411CW, 411DW, 411EW, 851AW, 851BW
		C+20 - C+29	2	3 - Hospital beddown and base camp development	510AB, 550BB, 725AB, 725BB
		C+30 - C+39		4 - Revetments for aircraft	149AB, 149AW
			3	5 - Storage and critical maintenance facilities	441AB, 442AB, 214AB, 211AB, 217AB

Figure B-1. SAMPLE SCENARIO PARAMETERS

TIME-PHASED MANHOURS OF EFFORT BY PRIORITY, REGION AND CONSTRUCTION SKILL. These data were used to develop the graphics and tables found in Figures 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19 in the main paper.

Priority		MANHOURS of EFFORT (Total per Time Period)								
1	Time Periods	REGION 1 REQUIREMENTS				REGION 2 REQUIREMENTS				Totals
		Horz	Vert	Gen	Total	Horz	Vert	Gen	Total	
	C+0 - C+9	100	200	300	600	100	300	300	700	1,300
	C+10 - C+19	200	100	400	700	200	300	200	700	1,400
	C+20 - C+29	300	200	400	900	200	400	300	900	1,800
	C+30 - C+39	200	100	300	600	100	100	200	400	1,000
	TOTAL	800	600	1,400	2,800	600	1,100	1,000	2,700	5,500
2	C+0 - C+9	200	400	600	1,200	200	400	400	1,000	2,200
	C+10 - C+19	400	200	800	1,400	300	400	300	1,000	2,400
	C+20 - C+29	600	400	800	1,800	300	500	400	1,200	3,000
	C+30 - C+39	400	200	300	900	200	200	200	600	1,500
	TOTAL	1,600	1,200	2,500	5,300	1,000	1,500	1,300	3,800	9,100
3	C+0 - C+9	300	600	900	1,800	400	200	200	800	2,600
	C+10 - C+19	600	300	1000	1,900	600	200	100	900	2,800
	C+20 - C+29	900	600	1000	2,500	600	300	200	1,100	3,600
	C+30 - C+39	600	300	500	1,400	400	100	100	600	2,000
	TOTAL	2,400	1,800	3,400	7,600	2,000	800	600	3,400	11,000
REGIONAL		4,800	3,600	7,300	15,70	3,600	3,400	2,900	9,900	25,600

Figure B-2. SAMPLE DATA BY PRIORITY, REGION AND CONSTRUCTION SKILL

TIME-PHASED MANHOURS BY PRIORITY, REGION, SERVICE AND CONSTRUCTION SKILL. These data were used to develop the graphs and tables in Figures 10, 11, 12, 14, and 15 in the main paper.

MANHOURS of EFFORT
(Total per Time Period)

Priority	Time Periods	REGION 1 REQUIREMENTS				REGION 2 REQUIREMENTS				TOTALS
		Horz	Vert	General	Total	Horz	Vert	General	Total	
		SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2
1	C+0 - C+9	150 / 50	50 / 150	200 / 100	300 / 300	100 / 0	200 / 100	150 / 150	450 / 250	750 / 550
	C+10 - C+19	150 / 50	50 / 50	300 / 100	500 / 200	100 / 100	200 / 100	150 / 50	450 / 250	950 / 450
	C+20 - C+29	200 / 100	50 / 150	200 / 200	450 / 450	100 / 100	300 / 100	200 / 100	600 / 300	1050 / 750
	C+30 - C+39	100 / 100	50 / 50	200 / 100	350 / 250	0 / 100	50 / 50	100 / 100	150 / 250	500 / 500
	Total	500 / 300	200 / 400	900 / 500	1600 / 1200	300 / 300	750 / 350	600 / 400	1650 / 1050	3250 / 2250
2	C+0 - C+9	200 / 0	400 / 0	600 / 0	1200 / 0	100 / 100	0 / 400	100 / 300	200 / 800	1400 / 800
	C+10 - C+19	200 / 200	150 / 50	300 / 500	650 / 750	100 / 200	100 / 300	150 / 150	350 / 650	1000 / 1400
	C+20 - C+29	100 / 500	200 / 200	500 / 300	800 / 1000	150 / 150	200 / 300	100 / 300	450 / 750	1250 / 1750
	C+30 - C+39	100 / 300	0 / 200	200 / 100	300 / 600	200 / 0	150 / 50	100 / 100	400 / 200	700 / 800
	Total	600 / 1000	750 / 450	1600 / 900	2950 / 2350	550 / 450	450 / 1050	450 / 850	1450 / 2350	4400 / 4700
3	C+0 - C+9	200 / 100	400 / 200	500 / 400	1100 / 700	100 / 300	0 / 200	0 / 200	100 / 700	1200 / 1400
	C+10 - C+19	300 / 300	100 / 200	700 / 300	1100 / 800	200 / 400	100 / 100	0 / 100	300 / 600	1400 / 1400
	C+20 - C+29	200 / 700	300 / 300	300 / 700	800 / 1700	300 / 300	100 / 200	100 / 100	500 / 600	1300 / 2300
	C+30 - C+39	100 / 500	200 / 100	100 / 400	400 / 1000	100 / 300	0 / 100	100 / 0	200 / 400	600 / 1400
	Total	800 / 1600	1000 / 800	1600 / 1800	3400 / 4200	700 / 1300	200 / 600	200 / 400	1100 / 2300	4500 / 6500
	Regional Totals	1900 / 2900	1950 / 1650	4200 / 3200	7950 / 7750	1550 / 2050	1400 / 2000	1250 / 1650	4200 / 5700	12150 / 13450

Figure B-3. SAMPLE DATA BY PRIORITY, REGION AND SERVICE

TIME-PHASED MANHOURS BY PRIORITY, REGION AND TASK INCREMENT. The data provided in this table were used to develop the graphs and tables in Figures 12 and 14 in the main paper.

MANHOURS of EFFORT
(Total per Time Period)

Priority	Time Periods	REGION 1 REQUIREMENTS				REGION 2 REQUIREMENTS				TOTALS
		INCREMENTS				INCREMENTS				
		INC 1 / INC 2	INC 3 / INC 4	INC 5	Total	INC 1 / INC 2	INC 3 / INC 4	INC 5	Total	
1	C+0 - C+9	100 / 500			600	200 / 500			700	1300
	C+10 - C+19	500 / 200			700	400 / 300			700	1400
	C+20 - C+29	400 / 500			900	300 / 600			900	1800
	C+30 - C+39	250 / 350			600	100 / 300			400	1000
	Total	1250 / 1550			2800	1000 / 1700			2700	5500
2	C+0 - C+9		300 / 900		1200		300 / 700		1000	2200
	C+10 - C+19		1000 / 400		1400		600 / 400		1000	2400
	C+20 - C+29		1600 / 200		1800		800 / 400		1200	3000
	C+30 - C+39		700 / 200		900		300 / 300		600	1500
	Total		3600 / 1700		5300		2000 / 1800		3800	9100
3	C+0 - C+9			1800	1800			800	800	2600
	C+10 - C+19			1900	1900			900	900	2800
	C+20 - C+29			2500	2500			1100	1100	3600
	C+30 - C+39			1400	1400			600	600	2000
	Total			7600	7600			3400	3400	11000
	Regional Totals	1250 / 1550	3600 / 1700	7600	15700	1000 / 1700	2000 / 1800	3400	9900	25600

Figure B-4. SAMPLE DATA BY PRIORITY, REGION AND TASK INCREMENT

TIME-PHASED CAPABILITY MANHOURS BY REGION, SERVICE AND CONSTRUCTION SKILL. The data provided in this table were used to develop the graphs and tables in Figures 15, 16, 17, 18 and 19 in the main paper.

MANHOURS of CAPABILITY
(Total per Time Period)

	REGION 1				REGION 2				
	Horz	Vert	General	Total	Horz	Vert	General	Total	TOTALS
Time Periods	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2	SVC 1 / SVC 2
C+0 - C+9	0 / 0	0 / 0	0 / 0	0 / 0	0 / 100	0 / 50	0 / 50	0 / 200	0 / 200
C+10 - C+19	100 / 200	100 / 100	50 / 50	250 / 350	0 / 200	0 / 150	0 / 100	0 / 450	250 / 800
C+20 - C+29	400 / 300	350 / 250	100 / 200	850 / 750	0 / 400	0 / 400	0 / 300	0 / 1100	850 / 1850
C+30 - C+39	500 / 300	500 / 250	300 / 200	1300 / 750	200 / 400	300 / 400	100 / 300	600 / 1100	1900 / 1850
								Total	3750

Figure B-5. SAMPLE CAPABILITY DATA

LAST PAGE OF ANNEX B

ANNEX C

ABBREVIATIONS AND ACRONYMS

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ANNEX C

ABBREVIATIONS AND ACRONYMS

AAP	Attack Assessment Program
ABFCS	Advanced Base Functional Component System
AFCS	Army Facilities Component System
AFESC	Air Force Engineering Services Center
ALSS	advanced logistic support sites
AO	area of operations
ASG	area support group
AWCM	Area Wartime Construction Management
CATCODE	category code
CESPG	Civil Engineer Support Plan Generator
CINC	Commander-in-Chief
CSG	corps support group
DOS	days of supply
EAC	echelons above corps
ECAPB	engineer capability
Ech	echelon
ENCOMs	engineer commands
EPW	enemy prisoner of war
ESC	Engineer Studies Center
etc.	etcetera
FMP	facilities mobilization plan
FRN	force requirement number
GEOLOC	geographic location code
Gen	general
HN	host nation
Horz	horizontal
i.e.	for example
incrmt	increment
JCLs	job control languages
JCS	Joint Chiefs of Staff
LOTS	logistics-over-the-shore

MEDIVAC	medical evacuation
MJCS	Memorandum from the Joint Chiefs of Staff
MP	military police
MSR	main supply route
NAVFAC	Naval Facilities Engineer Command
OPLAN	operations plan
PER	period
POE	points of embarkation
POL	petroleum, oil and lubricants
POD	points of debarkation
PRTY	priority
RDD	required delivery date
REG	region
RPI	real property index
RRR	rapid runway repair
svc	service
TAACOM	Theater Army Area Command
TACAPS	Theater Army Construction Automated Planning System
TM	technical manual
Totl	total
TPFDL	time-phased force deployment list
UOM	unit of measure
U.S.	United States
USCENTCOM	United States Central Command
UTC	unit type code
vert	vertical
WWMCCS	Worldwide Military Command and Control System

LAST PAGE OF ANNEX C

Engineer Studies Center	1,001 USES FOR CESPG OUTPUT: HOW TO TURN DATA INTO INFORMATION	STUDY GIST CEESC-R-91-19

FINDINGS: Data generated by the Civil Engineer Support Plan Generator (CESPG) model can support decision-making in four main areas:

1. **TPFDL Structuring.** The requirements generated by the model can assist you in justifying **how many** engineers should be placed on the time-phased force deployment list (TPFDL), **when** they need to arrive, and **what locations** need the most engineer support.

2. **OPLAN Supportability.** Data from the CESPG also helps in identifying shortfalls and excesses in engineer support by base complex.

3. **Class IV Requirements.** Class IV tonnage requirements generated by the CESPG can be used by logisticians in planning movement of men and materials.

4. **Host Nation Support.** You can also use the model's output to identify possible areas for host nation or contract support agreements based on the type, amount, and timing of the requirements.

MAIN ASSUMPTION: The CESPG is the only tool available to civil engineer "war planners" that estimates war-time requirements for engineer support in the echelons-above-corps area of operations.

PRINCIPAL LIMITATION: The handbook does not provide an in-depth analysis of the operational aspects of the model. It concentrates on explaining files, data requirements, and analysis methods to the "non-technical" user.

SCOPE OF THE STUDY: The handbook includes:

- A brief background on the CESPG model, its intended uses, traditional complaints, and problems.
- An overview of the model, its structure and output.
- Presentation of methods developed by the Engineer Studies Center (ESC) for use in various engineer assessments to support theater level planning.

STUDY OBJECTIVE: This user's guide provides CESPG planners with methods that use computer generated data to support deliberate planning. The main objective is to provide insights and methods for using CESPG results. Equations and detailed mathematical explanations will not be found, rather, samples of how the data is arrayed. Graphic displays are shown that can aid the decision-maker in interpreting the impact of the results.

BASIC APPROACH: This handbook was prepared by relying on personal experiences with the CESPG over the last six years and addressing areas that were most often questioned.

REASONS FOR PERFORMING THE STUDY: The CESPG model was developed in the 1970's. Its purpose is to provide theater-level planners from all services a unified, consistent, and comparable method of determining engineer requirements at echelons above corps and assess the ability of the available engineer forces to accomplish those requirements. Over the last five years ESC has used the CESPG as the basis to generate engineer requirements for several Army and Joint engineer assessments. It is believed that by sharing the insights and knowledge gained through these experiences, future CESPG action officers will have a less painful road to travel.

STUDY SPONSOR: The Joint Chiefs of Staff, J-4 Civil Engineering Branch, sponsored the study.

PERFORMING ORGANIZATION AND PRINCIPAL AUTHORS: This study effort was performed by CEESC under the direction of Mr. Stephen Reynolds. The principal author was Ms. Susan J. Wright.

DTIC ACCESSION NUMBER OF FINAL REPORT: Pending.

COMMENTS AND SUGGESTIONS MAY BE SENT TO: Commander, U.S. Army Engineer Studies Center, Casey Building #2594, Ft Belvoir, VA 22060-5583.

START AND COMPLETION DATES OF STUDY:

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